THURSDAY, SEPTEMBER 30, 1915.

ENGINEERING MATERIALS.

(1) *Materials of Construction: Their Manufacture, Properties, and Uses.* By Prof. A. P. Mills. Pp. xxi+682. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1915.) Price 19*s*. net.

(2) *The Strength of Materials: A Text-book for Engineers and Architects.* By E. S. Andrews. Pp. x+604. (London: Chapman and Hall, Ltd., 1915.) Price 10*s*. 6*d*. net.

(1) "MATERIALS of Construction," by Mr. A. P. Mills, is an excellent text-book covering a wide field, including cementing materials, masonry, bricks and clay products, ferrous and non-ferrous metals and timber. Generally a short historical statement is given, a list of applications in the arts, a well-illustrated description of manufacturing processes, an account of chemical, physical, and mechanical properties, and some statistics of American production. The information is based largely, but not exclusively, on American experience, but is not less interesting on that account. English readers will be glad to become acquainted with the very trustworthy results of tests obtained by the U.S. Bureau of Standards, the Structural Materials Laboratory of the U.S. Geological Survey, and the laboratory of the U.S. Forest Service, as well as the investigations of the active American Society for Testing Materials.

The treatise is very comprehensive. For instance, in treating cements, there are separate chapters on gypsum plasters, quicklime, hydrated and hydraulic limes, Puzzolan and slag cements, natural cements, Portland cement and concrete. Or again, in dealing with ferrous metals, chapters on pig iron, cast iron, malleable cast iron, wrought iron, steel, and the special alloy steels. There is adequate criticism of the processes, the tests, and the investigations described.

Only a few points of interest can be referred to. The researches of Le Chatelier, Törnebohm, and the Newberrys on the constitution of Portland cement are carefully summarised, and the chemical, optical, and thermal researches at the Carnegie Geophysical Laboratory at Washington, which on the whole confirm the results of Le Chatelier. Standard American tests for cement are given and the conditions influencing the results are discussed. Curiously, rather little is said of methods of testing. The diagrams of tensile strength of 1:2, 1:3, and 1:4 cement mortars with sand graded to different fineness are instructive, and a constant relation of density and strength was observed. Diagrams of the ratio of compressive to tensile strength, based on an extensive series of tests of neat cement and cement mortars made for the U.S. Geological Survey, are interesting.

It appears that charcoal is used in the production of about 1 per cent. of pig iron in the United States. A brief account is given of electric furnaces, the product of which is claimed to equal in quality Swedish charcoal iron. It is stated that the electric furnace used for steel-making has already become a formidable rival of the crucible process, because it is able to make larger tonnages of tool steel of crucible quality at lower cost. It has also advantages in the production of alloy steels in that it need not be operated under oxydising conditions.

The mechanical properties of materials are shown by numerous graphic diagrams, which condense in small space a large mass of results. It is interesting that the U.S. standard specifications for iron and steel express the elongation per cent. in the form constant/(ultimate tensile strength). This is the adoption of the Tetmajer coefficient of quality in commercial testing. The deviation of this rule from the results of tests, which is not inconsiderable, is shown in Fig. 263. Prof. Hatt's results on the ratio of elongation and work of rupture in static and dynamic tests will be new to most English engineers. The treatment of fatigue is imperfect.

(2) "Strength of Materials" is properly understood to relate to the methods and results of the experimental investigation of the physical constants of materials of construction and the testing of the quality of supplies from different sources. It touches, on one side, the mathematical theory of elasticity, and on the other, applications in the theories of machines and structures. In the volume by Mr. Andrews all these branches of applied mechanics are treated together, and strength of materials in the restricted sense is rather perfunctorily dealt with. Riveted joints, beams, struts, shafts, flat plates, and rotating discs are discussed mainly from a purely mathematical point of view, graphic methods being largely employed.

No doubt the book will be useful to students and young engineers, especially because so many special cases are worked out algebraically and numerically in detail. At the same time it is doubtful if the author has quite digested his reading. On some fundamental points he is obscure. Discrepant solutions are placed side by side, and the student left to his own resources or put off with "we believe." Thus two theories are given of the simple case of a rectangular reinforced beam. In a numerical example the bending moment comes out three times as great by one as

by the other. The calculation of deflections by "Mohr's method" is good. But the whole subject would have been much clearer if the well-known principle had been explained, that the load, shearing force, bending moment, slope and deflection curves form a series each derived from the next by graphic integration.

The phrasing is often loose. "For most metals . . . the yield point is reached when there is a sudden large increase in strain." Only in a few metals is there a yield point in this sense. The whole account of fatigue is unsatisfactory. The author is in confusion between the old view of Claxton Fidler, who must always be spoken of with respect, who believed that the Wöhler effect was purely the result of dynamic action, and what is now clear that there is a real "fatigue" due to slip fissures developing at first slowly, but at last rapidly and locally. It is true that American engineers have mixed up an allowance for fatigue and for impact in the case of railway bridges. But that is wrong in principle. Strictly, the fatigue allowance is not one of the factors which make up the factor of safety, but like the yield point, the fatigue limit is a stress not to be exceeded when the total stress due to load, impact, and contingencies has been calculated. To the author "the subject is still full of difficulties" (p. 89). At this late date it is odd to read "we will make the following assumptions in developing *our* theory of torsion" (p. 317). The use of alignment charts in designing springs seems new (p. 342).

PLANTS OF FORMOSA AND THE RIVIERA.

(1) *Icones Plantarum Formosanarum nec non et Contributiones ad Floram Formosanam.* Vol. iv. By B. Hayata. Pp. vi+264+xxv plates. (Taihoku: Government of Formosa, 1914.) n.p.

(2) *Flowering Plants of the Riviera.* By H. Stuart Thompson. With an Introduction on Riviera Vegetation. By A. G. Tansley. Pp. xxix+249. (London: Longmans, Green, and Co., 1914.) Price 10*s.* 6*d.* net.

(1) THE fourth volume of Dr. Hayata's great work on the flora of Formosa, modestly described as "materials for a flora of the island," based on a study of the collections of the Botanical Survey of the Government of Formosa, contains descriptions of 285 species, of which no fewer than 167 are new to science, including a new orchid genus Arisanorchis of considerable interest as adding another member to the small list of leafless saprophytes in this family. Moreover, thirteen genera are mentioned as new to the Formosan flora, these including such well-known genera as Aconitum, Cornus, and Hydrocharis. This volume brings the total number of species of the flora up to more than 3000, and we are promised several more volumes, indicating the remarkable floristic richness of the island.

In his interesting introduction the author suggests two resolutions regarding the description of new species of plants for consideration at the meeting of the International Botanical Congress fixed for the summer of 1915 in London, "if the present overwhelming war is then over." This introduction is dated August 31, 1914. As usual in Dr. Hayata's works, the illustrations are numerous and beautifully executed, and the whole reflects the greatest credit upon the author and upon the enlightened Government of Japan. It is worthy of note that the author has preferred to follow the classification of Bentham and Hooker rather than that of Engler and Prantl, and this appears a wise choice, for although the former system may be in various respects inferior as a method of presenting the genetic affinities of the families of plants, the latter is far from being a natural system, and is constantly undergoing modification. This being the case, adherence to the older system, for purposes of ready comparison between different floras, is perhaps on the whole the best course to adopt.

(2) The author's previous volumes on alpine and subalpine plants fully demonstrated his facility for popular yet accurate plant description, and he has had long personal acquaintance with the region here dealt with. The flora is arranged on the Bentham and Hooker system, thus facilitating comparison with French works on the flora of the Riviera, in which the system used is practically identical with the English one. The author has spared no pains to make it easy for those with even a slight knowledge of botanical terminology to identify the plants described, for the actual descriptive part is preceded by synopses of family characters and keys to the tribes and genera, and there is also a full and clear glossary of terms used. As the subtitle ("A Descriptive Account of 1800 of the More Interesting Species") indicates, the book does not profess to be an exhaustive "flora," but though the botanist may regret the incompleteness which is particularly noticeable in the case of some of the larger families and genera, these cases nearly all refer to groups which the non-professional botanist would find unattractive. The author wisely refrains from the attempt, which mars many books of this scope, to manufacture so-called English names for species.

The plates, both coloured and plain, are exceedingly good, and a valuable feature of the book is the interesting but disappointingly brief introduction by Mr. Tansley, which deals with the ecology

of the Mediterranean vegetation and the various plant communities represented in the Riviera. However, brief as it is, this introduction gives a remarkably clear picture of the vegetation, such points as the relations of soils and the striking effects of exposure and shelter being well brought out. Those who hope to visit or revisit this beautiful region, when happier times arrive, should have Mr. Thompson's book on Riviera flowering plants.

TWO HANDBOOKS OF EXPLORATION.

(1) *Stories of Exploration and Discovery.* By A. B. Archer. Pp. x+198. (Cambridge: At the University Press, 1915.) Price 2*s.* 6*d.* net.

(2) *The North-West and North-East Passages, 1576–1611.* Edited by P. F. Alexander. Pp. xx+211. (Cambridge: At the University Press, 1915.) Price 2*s.* 6*d.* net.

(1) MR. ARCHER'S book supplies a short history of exploration in simple language. It opens perhaps a little uncertainly on the importance of the Eastern Mediterranean as the earliest known centre from which knowledge of the world was extended outwards. "The Egyptians used boats on the Nile, and perhaps along the coasts of their country, but probably the first serious navigators were the people of Phœnicia"—this, in the light of recent research concerning early Mediterranean peoples, is not a wholly satisfactory summary. The subsequent chapters are handled more firmly, and the rather difficult task of balancing between topographical correlation and historical sequence is judiciously carried out. The final chapters on modern polar exploration, however, are less successful. They maintain the interest to the student, but sometimes a point is missed: thus, it is an unfortunate version of the dramatic encounter between Nansen and Jackson which states that Nansen and Johansen "reached the south of Franz Joseph Land, where to their delight a relief ship was waiting." There is a short bibliography of easily-accessible books of reference, and a good index is provided. There are also some rough but sufficiently clear maps, and some clever adaptations of old maps.

(2) Mr. Alexander's book contains a series of extracts from original narratives of voyages in search of the north-west and north-east passages, together with an explanatory introduction, a chronology of important dates in geographical discovery generally, and notes. The extracts are from George Best's account of Frobisher's first and second voyages, from the narratives of Davis's three voyages and of Hudson's last voyage, and from de Veer's account of Barents's third voyage; which is supplemented by an account of the discovery, in modern times, of relics of that voyage. Hakluyt, Purchas, and the Hakluyt Society's second edition of Phillip's translation of de Veer have been drawn upon. The modernising of these texts, so far as necessary, has been carried out without any of the charm of the original being lost. It is this peculiar charm which makes these narratives most attractive to the student for whom these volumes are designed—for it should be added that this book belongs to a series to be known as "Cambridge Travel Books," of which another, "The Earliest Voyages Round the World," is stated to be in the press. The book is excellently produced, and the original illustrations reproduced are as instructive as they are amusing; there are also a few explanatory maps. It can only be a question whether in a book of this compass, designed for the purposes indicated, there should not be shorter extracts from more narratives, but no doubt it would be difficult, if not impossible, to carry out such a plan and maintain the interest of the originals.

OUR BOOKSHELF.

Aids to the Analysis and Assay of Ores, Metals, Fuels, etc. By J. J. Morgan. 2nd edition. Pp. viii+138. (London: Baillière, Tindall and Cox, 1915.) Price, cloth, 3*s.* net; paper, 2*s.* 6*d.* net.

THE first edition of this capital little book has been useful to students of evening classes for a number of years, and the appearance of the second edition will be welcome to their instructors in metallurgical analysis. The general arrangement is good, and has been maintained unchanged, but the book has been considerably enlarged. In addition to descriptions of the assay of the ores of the common metals and of the complete analysis of commercially impure metals, sections are devoted to special steels and other alloys, fuels, furnace materials, and slags. There is also some account of the analysis of the by-products of coke-ovens. The characteristic of the book is that as a rule only one method of determination is given in each case, but the methods are well chosen as having stood the test of time, and the descriptions are concise and accurate. Little is said about apparatus and reagents; there are few illustrations, and in general the book seems to be intended rather to remind students of what they have been taught than to take the place of laboratory demonstration. In cases where the more expensive standard works on analysis and assaying are inaccessible, this handy volume will be found to take their place with scarcely any disadvantage. It is small enough to slip into the pocket.

Alignment Charts: their Principle and Application to Engineering Formulae. By E. S. Andrews. Pp. 32. (London: Published for James Selwyn and Co. by Chapman and Hall, Ltd.) 1*s.* 3*d.* net.

ALIGNMENT charts have been used to some extent by engineers in recent years, and are capable of being employed to a much greater extent. The

method was developed very largely by Prof. Peddle, of the Rose Polytechnic Institute, U.S.A., and his method of treatment has been followed by the author of the little book before us, with some variation in details. In this system of plotting scales of the variables involved are set off along parallel lines, and a straight-edge laid across the lines enables one of the variables to be determined when the others are given. The author describes methods to be followed when there are three, four, or more variables, and gives illustrations of the plotting of reinforced concrete column, boiler shell, steel beams, shafts, and other engineering formulæ.

Most of the illustrations are clear and easy to read; Figs. 1 and 2 are exceptions, the lettering and printing being poorly executed. There are very many problems of a repetition character in engineering, and much time can be saved by charts of this kind. There is also less risk of error in the results, once the chart has been correctly drawn. We can commend the book to engineers who wish to make themselves acquainted with this labour-saving device.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Mathematical Printing.

YOUR remarks in NATURE (September 16, p. 79) relating to the important suggestions on mathematical printing recently circulated by the London Mathematical Society, are confined to the examination of special points, in the light partly of application to the special case of an analytical memoir on dynamics of aeroplanes.

It is worth while to direct special attention to what is perhaps the main recommendation, for examples of its disregard are still conspicuous. The introduction of the notation of the solidus or oblique bar for fractions has had much to answer for, especially in this country, on account of its use in excess—for example, in reducing long formulas to the deal-level of a single line, thus obscuring their structure without any compensating gain. As originally revived by Sir George Stokes, and largely adopted on his suggestion, the intention was to render possible the printing of brief expressions isolated in the current text or elsewhere, without disturbing the line; its use for reducing a formula already specially set out, and involving a sum of fractions, to a single line of type, is usually to be deprecated.

The suggestion to replace the dot over a letter, the Newtonian symbol of its fluxion, by an accent following it, was put forward, doubtless with regret, as the lesser evil. If only printers would provide special types with the dot attached for the small number of letters likely to be thus affected, no change would be necessary. JOSEPH LARMOR.

Cambridge, September 24.

Palæolithic Man in South Africa.

I HAVE read in NATURE of August 5, just received, Mr. F. W. Fitzsimons's letter referring to the discovery of Palæolithic man in South Africa. I would not trouble you with these lines were it not that many of its statements are erroneous. Moreover, owing to my name being mentioned in connection with a detailed examination which is being carried out in this museum, it might be thought that I am in part responsible for the conclusions which Mr. Fitzsimons enumerates. As a matter of fact, I informed him, when first the skull was sent to us, and again some nine months ago, that the fragment was not referable to the Neanderthal type. There is, therefore, no more justification in the statement he makes that there is "a close resemblance in shape, thickness, and measurements" of the Boskop to the Neanderthal than in his generalisation on the origin of the Palæolithic implements in South Africa, or in the state of mineralisation of the relic—"The skull is as completely fossilised as the Karoo fossil reptiles," which are Permian and Triassic.

The result of a preliminary investigation of the skull by our palæontologist will be read shortly before the Royal Society of South Africa. Until then I cannot give any details beyond referring those interested in the subject to a short note by Prof. Boule in *L'Anthropologie* (vol. xxv., September–December, 1914, p. 595). L. PERINGUEY.

South African Museum, Cape Town,
Cape of Good Hope, September 2, 1915.

The Aurora Australis of June 17, 1915.

IT is interesting to learn, as a complement to the description of the Aurora Borealis by Prof. Barnard in NATURE of July 15 as accompanying the magnetic storm of June 17, 1915, that a display of aurora was also observed in the southern hemisphere. My correspondent, Mr. W. E. McAdam, writes:—"Upon that day (June 17) there was an exceptionally fine display of the Aurora Australis visible all over New Zealand. Here at Dunedin it commenced at 7.30 p.m., and lasted till midnight. The glow in the southern horizon was quite uncanny in effect, producing the illusion that the sun was about to rise in an impossible quarter of the sky, and at an impossible hour. I have been resident in the Southern Hemisphere off and on for over fifty years, and have never seen anything to equal this last display of the Aurora Australis, a somewhat rare phenomenon in the latitude of Dunedin, 46° south." A. L. CORTIE.

Stonyhurst College Observatory, Blackburn,
Lancs, September 25, 1915.

Distances at which Sounds of Heavy Gun-firing are Heard.

BEING much interested in the question of the distance of propagation of the sound of the firing of big guns, I should be much obliged to any readers of NATURE who could send me some personal observations on the matter, or let me know whether (and when and where) any notices on the subject have been published. Exact references are wanted, as I should try to get the papers containing the information. The gun-firing from the Belgian coast is probably heard in England at times. How far inland? All information will be gratefully received by me.

HENRY DE VARIGNY.

18 rue Lalo, Paris, September 17.

Nodules on the Intermediate Bladderwort.

MR. H. EVANS (NATURE of September 23, p. 88) should refer to Hooker's "Student's Flora," p. 311, Utricularia, "propagated by hybernacula"; and to Babington's "Manual of Botany," p. 339, *Utricularia intermedia* "increasing by buds at the end of the shoots and seldom flowering."

ELEONORA ARMITAGE.

Dadnor, Ross, Herefordshire, September 25.

THEORY AND PRACTICE OF FLYING.[1]

THE present notice refers to three new books on the theory and practice of flying. Although dealing with the same general subject, the ground covered by each is almost entirely different from that of the other two, and each has its own special interest.

"Aeroplanes and Dirigibles of War" deals with the uses of aircraft in the present war and with the methods of repelling aircraft attack by fire from the ground; the work contains very little technical matter, no attempt having been made to enter into details of construction. As showing the part which aircraft is playing in the world-war, the book can be read and appreciated with or without technical knowledge of aeronautics.

The other books under notice are largely technical, referring to aero-engines and to aeroplanes respectively. In the first of these, details of engines suitable for use in aeronautical work are shown with numerous illustrations; there is little theoretical matter, and scarcely any aerodynamics. The book on aeroplanes is, however, almost entirely devoted to aerodynamics, and summarises the important features as affecting the aeroplane so far as they lie within present knowledge. Having said so much generally, the further more particular notes may be of interest:—

(1) The book opens with interesting chapters on the history and development of free ballooning, tracing the military use of balloons back to 1884 and incidentally claiming for the British Government "superiority and initiative." In spite of more recent developments the author says that the use of balloons is still so important that no one of the belligerents will seriously consider their disuse. Passing from balloons to dirigibles, the early struggles of Count Zeppelin with his enormous rigid airships naturally receive much attention. Other types, including the Parseval and Astra-Torres non-rigid airships, come under review, but the author says of the Zeppelins that they have given airship supremacy to Germany. As a somewhat curious offset to this, the author quotes with approval a decision of the American military authorities that "dirigibles are not worth their cost as offensive machines," a decision which may after all prove to have been too sweeping.

After reading these early chapters, the section on aeroplanes is disappointing. In respect to British military machines in particular the author appears to have been singularly misinformed. As an instance of this, it is stated that the BE type of aeroplane has a maximum speed of 40–50 m.p.h., and to anyone acquainted with the technical flight journals such a statement is patently wrong. As a matter of fact, the lowest flight speeds are of the order of those mentioned, whilst the highest were more nearly 70–80 m.p.h. at the beginning of the war.

Coming to anti-aircraft guns and bomb-dropping the book again becomes interesting. One of the illustrations reproduced in Fig. 1 shows a mobile anti-aircraft gun as manufactured by Krupp. Some of these guns are said to throw a shell weighing 40 lb. to a height of 6000–8000 ft., forcing the aviator to similar heights for safety. From such heights the accurate dropping of bombs is a task of some difficulty, and success is often attained only by the pilot running the risk of destruction by shell-fire at much lower altitudes.

FIG. 1.—The latest Krupp anti-aircraft gun, showing novel disposition of wheels. From "Aeroplanes and Dirigibles of War," by F. A. Talbot.

The author concludes with an expression of his opinion that aerial activity will increase with the duration of the war, a prediction which is already being justified by events.

(2) The most interesting and useful part of this book is the description in detail of a number of engines used in flight. The descriptions occupy about three-quarters of the whole and range from

[1] (1) "Aeroplanes and Dirigibles of War." By F. A. Talbot. Pp. xi+283. (London: W. Heinemann, 1915.) Price 3s. 6d. net.
(2) "Aero Engines." By G. A. Burls. Pp. x+196. (London: C. Griffin and Co., Ltd., 1915.) Price 8s. 6d. net.
(3) "The Aeroplane." By A. Fage. Pp. viii+136. (London: C. Griffin and Co., Ltd., 1915.) Price 6s. net.

the 25 h.p. Anzani, with which Blériot first flew the Channel, to some of the more modern engines of 200 h.p. The growth of the art of flying is strikingly illustrated by the fact that whilst 25 h.p. was a useful size of engine in 1909, no present-day aeroplane, other than those for school purposes, has a horse-power less than 80, whilst many considerably exceed this. The celebrated Gnome engine, by means of which Farman and Paulhan achieved their early successes, is described very fully. The power was then a nominal 50 h.p., but really only 42 h.p., but Fig. 2 shows a much larger model weighing only 540 lb., whilst developing 180 h.p. The complication of cylinders which is essential for light engines is most clearly shown in this illustration.

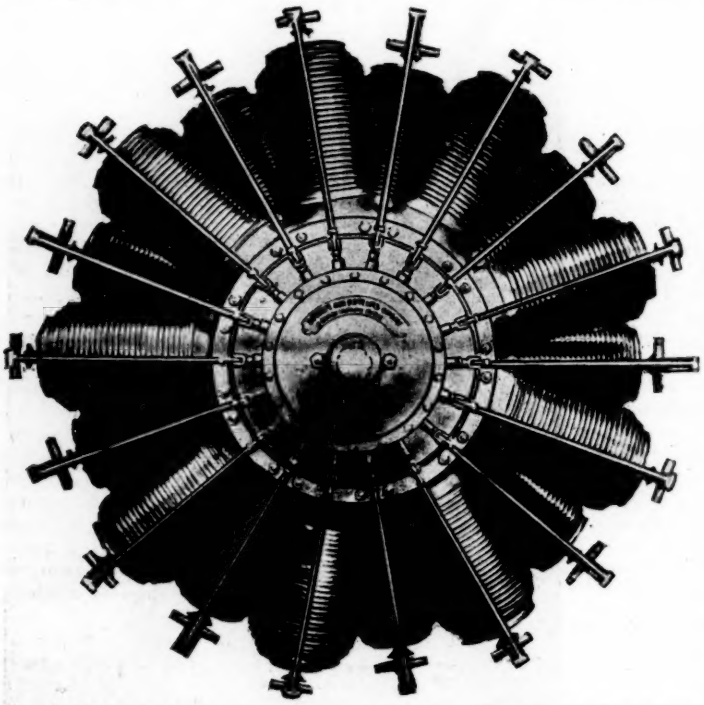


FIG. 2.—Eighteen-cylindered 200 h.p. Gnome rotary engine. From "Aero Engines," by G. A. Burls.

As engines get more and more powerful, the advantages of the rotary air-cooled type over the more trustworthy but somewhat heavier water-cooled engines become less and less, and may ultimately lead to extinction of the former type. The very high proportion of their existence which aero-engines spend in the repair-shop is clear evidence that finality of design is not yet even closely approached, but there is reason to hope that the introduction of large water-cooled engines will considerably reduce the time of repair without the disadvantage of greater weight.

The earlier part of the book contains theoretical matter relating to the working of hot-air engines and follows standard lines in most respects. After contrasting the weights of internal combustion engines, the air-cooled engine of about 3 lb. per b.h.p. with the workshop engine weighing 200 lb. per b.h.p., the author proceeds to a discussion of the working cycle. By some extraordinary calculation he concludes that an engine using the Carnot cycle would weigh 17 tons per b.h.p.; one feels that this is overdone, and that part of the trouble at least is not legitimately laid on the Carnot cycle, but should be borne partly by the designer and partly by the calculator.

Excursions into aerodynamics have already been stated to be few; they are also mostly unfortunate. It is stated that a reduction of gross weight of an aeroplane improves the gliding angle, whereas the two are independent, the effect of reducing the weight being to reduce the flying speed at the same gliding angle. A little later occurs a meaningless statement that "the power, *caeteris paribus*, varies as the cube of the air speed, etc." What the Latin expression covers it is not easy to see; for any given aeroplane the horse-power at first decreases as the speed increases, becomes steady, and then gradually increases. No power of the speed at all can be stated in such general terms. On the same page there occurs a conspicuous error in applying the principles of relative motion to flight in a gale.

These are, however, minor defects which can be put right in later editions, and the information on engines gives the book a right to the bookshelves of all serious students of aviation.

(3) This work is a summary of the dynamics of the aeroplane, and has apparently aimed at the suppression of detail in order to make the important features clear. The early part of the book is based on the results of tests at the various aerodynamical laboratories, on the lift and resistance of wing forms, and the resistances of wires, struts, wheels, etc. In dealing with the problem of flow, photographs are reproduced which indicate the difference between "stream-line" bodies and forms having high resistance. The "stream-line" body is shown as allowing the fluid to move in towards the tail, whilst in the blunter forms the tail region is occupied by eddies. This is one of the more clearly exhibited forms of the effects of viscosity, but in later photographs, showing the velocity of the fluid at any point, the very great difference between the flow round "stream-line" bodies and those of mathematical calculation is almost equally striking.

After discussing the effects of changes of sections of the wings on their efficiency, a few aeroplanes are described, with particulars as to

leading dimensions and weights, and such data is then used to show how the performance of an aeroplane may be calculated. The calculation involves the use of aerodynamical data already described, and also means of estimating the performance of propellers. The usual theory of propeller design is given, and although this now appears to be in need of improvement, the results obtained by its use have been of very great value. In addition to the calculations relating to equilibrium a chapter is included on the question of stability.

The book closes with a short description and discussion of aero-engines, and the whole appears to be very sound. The impression is left, however, that in the attempt to be concise too little assistance has been given to the reader. Like the book on aero-engines, by the same publisher, the production is excellent, the illustrations being particularly clear.

THE VISIBILITY OF DISTANT OBJECTS IN WARFARE.

THE long range of weapons employed in modern warfare has given importance to the study of the appearance of distant objects. A constant contest is taking place between the observer trying to locate the position and numbers of the enemy, and the observer who endeavours by all possible means to conceal these factors.

Generally speaking, an object becomes indistinguishable when its brightness and colour are identical with its surroundings. For this reason such colours as grey and khaki, which blend well with the surroundings, are preferred for modern uniforms. Yet their effectiveness in this respect depends on the nature of the ground over which troops are moving. Khaki is doubtless difficult to distinguish amidst sandy wastes; grey or green might be better against grass or foliage. Of all colours, red is the most conspicuous at a distance. Not only is it the colour which presents the most vivid contrast with the ordinary background, but there appear to be certain physiological factors which accentuate this impression. For example, it is well known that the central region of the eye (which is mainly used for the observation of distant objects) is highly sensitive to the red end of the spectrum and correspondingly insensitive to blue and green. It has also been alleged that, owing to the eye lens not being achromatic, most people find it difficult to focus distant blue and violet light; and that such objects readily merge in the landscape because their outlines are hazy and blurred. Skilful gardeners in designing a flower-bed arrange the blue and lilac flowers in the foreground when possible, and rely on vivid red and orange blooms for a distant effect.

It is known, however, that in a dim light the conditions obtaining in full daylight do not apply. In a feeble illumination the eye becomes more or less colour-blind and is highly insensitive to red, which appears dead black, whereas green and blue objects appear an uncanny grey. A party of men in grey-green uniforms advancing across a grass field in twilight would therefore be extremely difficult to detect.

All this suggests that the problem of selecting an inconspicuous uniform is a complicated one, especially when it is borne in mind that it is also important that bodies of men, besides being inconspicuous to the enemy, should be clearly visible to their own side. It has been suggested that this condition might be secured by differentiation in the colouring of the front and back of the uniform.

It is interesting to observe that on several occasions during the present war scouts have taken special steps to accommodate the colour of their clothing to the surroundings. For example, it is stated that the Germans provided some of their men with white uniforms in order to match the snow in the Polish campaign, and that the Turkish snipers in Gallipoli painted their hands and faces green so as to be indistinguishable amidst foliage.

It is clearly more difficult to secure resemblance to surfaces which are constantly changing, such as the sky and the sea. But there is a second principle which can also be used to secure inconspicuousness in these circumstances, namely, what may be termed the "patchwork" principle. This is based on the experience that the outlines of an object may be rendered difficult to distinguish by breaking up its surface with stripes and patches. This method has been applied to aircraft and hydroplanes, and to forts and temporary defences of various kinds. Besides painting the hulls and funnels of warships a slaty-blue or "battle-grey," experiments have been made with mottled patches of black and irregular serpentine black lines painted on a grey background. Some experiments in this direction recently carried out in the United States Navy are said to have been very successful, and it may be only a question of time before Dreadnoughts are rendered practically invisible at the long range of modern sea-battles.

A combination of patchwork and imitation of surroundings may also be applied with good results in order to conceal aerodromes and similar objects. For example, if the adjacent ground is cleared and the grass is scraped away at intervals, leaving bare patches, and if the aerodrome itself is painted a patchwork of brown and green, identification from above becomes very difficult. Yet another instance is furnished by the recent correspondence in the *Times* regarding the colour of sandbags. It is stated that the Germans insert black sandbags at intervals among those of lighter tint. An officer at the front wrote:—". . . It was the first thing I noticed about the German trenches. Their patchwork device made it impossible to spy their loopholes, whereas ours take a long time to build and then are easily seen."

A device such as this, which would apparently save a considerable number of lives in a long campaign, is well worth attention.

There remains one other possible device for concealing objects which, although difficult to

apply, is probably the most perfect of all when realisable. This is to make use of mirror or semi-mirror surfaces which reflect their surroundings and thus automatically imitate them. Such a device would be applicable in any surroundings.

The chief instance known to the author of the use of this method is afforded by the latest Zeppelins, which are reported to have a coating of bright aluminium powder, which reflects the sky and makes the vessel very difficult to detect at any considerable height. For aircraft flying at a height the problem of concealment is a particularly difficult one, as whatever pigment is adopted the framework is seen silhouetted against the bright sky. It is possible that by making use of reflecting surfaces, in addition to the other devices mentioned, this contrast could be considerably lessened. If to a noiseless engine could be added the quality of practical invisibility, aircraft would become very much more dangerous offensive machines than at present.

Such problems as those mentioned above seem to deserve careful scientific study. Methods of concealment may do much to save the lives of combatants. Moreover, the utility of all vessels employed for scouting purposes, whether aircraft, motors, or submarines, depends to a great extent on their escaping detection. It is therefore surely well worth while to follow up any train of research which offers any promise of approaching invisibility in the future. J. S. D.

PROF. W. H. H. HUDSON.

WE greatly regret to record the death, on September 21, of Prof. W. H. H. Hudson, at the age of seventy-six years. Born in London, he graduated as Third Wrangler in 1861. He was then fellow and lecturer of St. John's College until 1882, when he was appointed professor of mathematics at King's College, London. There, and also as professor of mathematics at Queen's College, Harley Street, he worked until his retirement about twelve years ago.

It is as a lecturer, and as a constructive reformer of the teaching of elementary mathematics that Prof. Hudson's vigorous influence will long be felt. Of his numerous pupils many became teachers, and the improvements in modern methods of teaching must be largely due to his inspiration. He edited Barnard Smith's "Arithmetic," published notes on dynamics, gave various addresses on the teaching of elementary mathematics, contributed to the mathematics of meteorology with a theory of anemoids, and did much to promote order and economy in the study of mathematics by adding to its vocabulary terms now generally found useful. He was an active member of the conference which reported to the London County Council on the teaching of arithmetic; of the councils of the London Mathematical Society and of the Mathematical Association; and of the governing body of Newnham College, in the welfare of which (as of the education of women generally) he was warmly interested.

Prof. Hudson's principles received remarkable vindication in the record of his family. By the tragic death on Snowdon, in 1904, of his only son, Cambridge lost one of its most brilliant Senior Wranglers, and perhaps the most widely accomplished. The researches of Ronald Hudson in Kummer's "Quartic Surface," published posthumously, placed him in the front rank of geometers. The three surviving daughters of Prof. Hudson have all distinguished themselves as mathematicians.

Few men intimate with the austerities of the most difficult of subjects can have made a wider circle of personal friends than did Prof. Hudson. He had the gift of humour and sympathy which endeared him to all those he taught. He enjoyed travel and recreation to the end of his days, and within the boundaries of mathematical study he knew how to find both.

NOTES.

THE Rev. Dr. E. W. Barnes, fellow and tutor of Trinity College, Cambridge, has been appointed to the mastership of the Temple. Dr. Barnes is in his forty-first year, and had a brilliant career at Cambridge. He went up to the University as a scholar of Trinity College, and in 1896 was bracketed second Wrangler. A year later he took a first class in the first division of the Mathematical Tripos, part ii., and was first Smith's prizeman in 1898, besides being president of the Union. He was elected a fellow of his college in the same year, and was an instructor at the Royal Military Academy, Woolwich, in 1898–99. He is the author of various memoirs and papers on Gamma functions, integral functions, linear difference equations, and related mathematical subjects.

THE Victoria Cross is given for conspicuous courage in the face of the enemy: and, if we want a good example of such courage, we have it in the English nurse, at the American Hospital at Neuilly, who inoculated herself with a pure culture of the bacilli of gas-gangrene, that she might help the discovery of the best treatment of that disease. We rejoice that she now is out of danger of death. The annals of medicine record many similar instances of self-devotion, and doubtless there are others which have gone unrecorded. They have not always been of use to mankind: John Hunter, for example, inoculated himself with the virus of one of the venereal diseases, but drew a wrong conclusion from the results of the experiment. The amazing self-experiments with yellow fever, in Camp Lazear, were happily not in vain. The protective treatments against cholera, plague, and typhoid fever were, of course, well tested by their discoverers on themselves before they were put to national uses. A good essay is waiting to be written on the whole subject of self-experimentation. Lord Moulton, in his evidence before the Royal Commission on Vivisection, discusses the ethics of it, and he does that very well. But formal ethics scarcely touch the case; the self-experimenter, in the presence of the enemy, the germs, the havoc they work on men, women, and children, "sees red," and behaves

accordingly. We salute with reverence this big-hearted Englishwoman, but we beg of her that she will not do it again.

We regret to learn of the death, on September 8, at eighty-one years of age, of Dr. Ugo Schiff, professor of chemistry in the R. Istituto di Studi Superiori, Florence.

Dr. C. H. Wing, professor of chemistry at Cornell University from 1870 to 1874, and at the Massachusetts Institute of Technology from 1874 to 1884, died recently at the age of seventy-nine.

The death is announced, in his fiftieth year, of Dr. K. E. Guthe, professor of physics at the State University of Iowa from 1905 to 1909, and at the University of Michigan since the latter date. A native of Hanover and educated in Germany, he went to the United States in 1892. He was a member of the jury of awards (electricity) at the St. Louis Exposition in 1904, and had made several contributions to the literature of physics.

Naturalists, and especially ornithologists, throughout the British Islands are the poorer for the sudden death on September 15 of Mr. R. M. Barrington, of Fassaroe, Bray, Co. Wicklow. Though in his sixty-seventh year, he was still full of activity and of enthusiasm for his favourite studies. An admirable example of the "all-round" naturalist, Mr. Barrington will be especially remembered for his work on the migration of birds. From 1880 he collected specimens forwarded to him by lightkeepers around the Irish coasts, and the results of these observations were published in a substantial volume in the year 1900. Many birds were thus recognised for the first time as Irish species—such as the yellow-browed warbler, the aquatic warbler, the barred warbler, Pallas's grasshopper warbler, the short-toed lark, the shore-lark, the mealy and Greenland redpolls. The specimens accumulated were either passed on to the National Museum in Dublin, or preserved in Mr. Barrington's beautifully kept private museum at Fassaroe, in which he took great pride and pleasure, and which he was always ready to show to friends, expounding the while from the wide experience with which his memory was stored. He was a keen botanist, having in his younger days paid especial attention to the Alpine plants of Ireland. He threw himself heartily into many enterprises for extending biological knowledge and interest, having been one of the founders of the Dublin Naturalists' Field Club, and a valued member of council of the Royal Irish Academy, the Dublin Society, and the Zoological Society of Ireland. To his wide knowledge of natural history there were added a personal charm and a kindly humour which will make the memory of his friendship a high privilege.

It has been found that at the present time there are three main causes which delay the production and repair of aircraft and their parts, namely, lack of co-ordination between those engaged in aeroplane construction, difficulties of finance, and shortage and wastage of labour. To remedy these disadvantages, it is proposed to establish a central body under the title "Aeronautical Production Committee" or some similar name, the functions of which will include the promotion of co-operation and co-ordination in the aeronautical industry, the provision of technical assistance otherwise unobtainable for financial institutions, and the development of arrangements for the better utilisation of the existing labour and the training of as many men for aeronautical work as the situation demands. It is estimated that an expenditure of about 100*l.* per week would enable the committee to supply the Army and Navy with seven more aeroplanes every week, and it is suggested that the sum might be raised partly by a Government subsidy, partly by a small fee charged to the makers for the benefits they would derive from the central bureau, and partly by voluntary subscriptions. The scheme has received the support of many eminent authorities, and further particulars can be obtained from the temporary secretary, Mr. L. Blin Desbleds, 39 Victoria Street, Westminster, S.W.

Just before five o'clock on Thursday morning last, September 23, a fire was discovered in the Technical School buildings, Market Street, Newton Abbot, and although the firemen succeeded in confining the outbreak to one room, much damage was done to the school museum, which included the life-long collection of the late Mr. W. Vicary, of The Priory, Exeter, bequeathed some years ago to his nephew, Mr. W. Vicary, chairman of the governors of the Technical School. The collection was considered to be one of the finest out of London, and many specimens were believed to be unique. It included thousands of specimens of minerals, some being very fine and rare. There were also some fine old flints from Dartmoor, stone implements, and a valuable collection of corals. Specimens from all parts of the world were included in the collection, and many cannot be replaced. There was also an extensive collection of butterflies of numerous varieties, and some magnificent examples of sampler work, some dating from the sixteenth century. The massive cases, valued at about 300*l.*, were completely destroyed, and it is probable that the bulk of the collection is rendered useless by the great heat. Other things lost are the records of the school from 1868, the year of its inception, and a collection of photographs, most of which cannot be replaced, of people who have been connected with the school.

A Home Grown War Food Exhibition, organised by the *Daily Mail*, was held at the Horticultural Hall, Westminster, last week. When it is considered that the growth, development, and power to function of all the tissues of the body are derived directly from the foodstuffs ingested, there need be no apology for investing these substances with an importance of the first order. To say that the exhibition was a success falls far short of the whole truth It has demonstrated that British people in their thousands (there were more than 20,000 competitors) can produce wheat, vegetables, eggs, butter, cheese, honey, and jams in quality as fine as any other nation in the world. Whether most of these foodstuffs can be produced as cheaply in this country as in France and

Germany remains to be seen. In agriculture, as in art and most departments of human activity, the French do things with singular brilliance and address. Now that we are drawn so closely to France, our agriculturists have excellent opportunities for studying her methods in the various ramifications of their calling. There is evidence to show that the freshness of food plays an important *rôle* in nutrition and problems of health. Since certain vegetables and fruits cannot be imported (even from the Continent) in a thoroughly fresh state, it follows that they should be raised at home. Apart from cost of carriage, there is no reason why we should not produce all our kitchen-garden material, many fruits, eggs, and butter and cheese as cheaply as any nation on the Continent. It requires no argument to-day to establish the contention that the health and physical conditions of the workers in this field are immeasurably better than in any sphere of activity afforded by the city. The only suggestion we have to make relating to the exhibition is that if a label bearing the name of the particular variety of foodstuff were attached to each exhibit, it would afford some valuable information to competitors and visitors. We should now like to see a further exhibition in the form of practical demonstrations of how the various foodstuffs should be cooked.

THE destruction of housefly maggots in manure and other food-stuffs is nowadays a pressing question with sanitary officers. Some recent American experiments are described in Bulletin 245 of the U.S. Department of Agriculture, written by Messrs. F. C. Cook, R. H. Hutchison, and F. M. Scales. Borax and powdered hellebore are found to be the most effectual "larvicides" of all the substances tested.

THE Trustees of the British Museum (Natural History) have published a valuable little pamphlet (Economic Series, No. 2), by Mr. Bruce F. Cummings, on the louse and its relation to disease. The structural distinctions drawn between the head louse and the clothes louse will be of interest to systematic entomologists, while the practical importance of the parasites as carriers of typhus and other diseases is duly emphasised.

THE Food Plants of the Gipsy Moth (*Porthetria dispar*) in America form the subject of Bulletin 250 of the U.S. Department of Agriculture by Mr. F. H. Mosher. From the careful experiments that he describes it has been established that the caterpillars eat, and thrive on, forty or fifty different kinds of trees. It is evident that such discursive feeding-habits make attempts to destroy the insects more difficult.

THE asparagus-beetle (*Crioceris asparagi*) is a well-known pest in Europe and North America. The life-history of its chalcid parasite, *Tetrastichus asparagi*, as lately described by Mr. F. A. Johnston (Journ. Agric. Research, Washington, vol. iv., No. 4), is of remarkable interest. The tiny fly lays usually from five to seven eggs in an egg of the beetle. The beetle's egg nevertheless hatches; the larva becomes fully grown, and, entering the soil, forms a pupal chamber. It never pupates, however, as the chalcid grubs have been feeding and growing within it; they crawl out of the dried cuticle and pupate in the earthen chamber which the host-larva has made.

AN interesting account of the colony of grey seals (*Halichoerus grypus*) of Skerryvore is given in the *Scottish Naturalist* for September by Mr. R. Wilson, of the Skerryvore Lighthouse. This colony, numbering from sixty to eighty, takes up its residence on the outlying rocks every summer, the majority leaving before the winter sets in. Among other things, he refers to their pugnacity towards one another, at any rate so far as the bulls are concerned, and of their curiosity.

THE *Zoologist* for August contains several interesting ornithological papers. Dr. J. M. Dewar discusses the relation of oyster-catchers to their environment from observations made along the Firth of Forth; he finds that the access of the birds to their feeding-grounds in winter is largely dependent on the movements and activities of the human population of the district. The Rev. J. M. McWilliam describes the habits of the tree sparrow in Co. Donegal, mentioning that a couple of males were observed feeding young in one nest, while a lonely female "was sitting on another nest not very far away." Mr. E. Selous continues his "Diary of Ornithological Observations" made in Iceland.

FURTHER notes on the colour sense in bees, from the pen of Mr. C. B. Moffat, appear in the *Irish Naturalist* for September. Mr. Moffat is of opinion that colour is a negligible factor as a means of guiding bees in their search for nectar. They depend rather, he believes, on some subtle sense, perhaps of scent, which enables them to keep to plants of one particular species during each separate journey to the hive. On the return from the hive plants of another species may be visited. Plants of the same species bearing respectively, say, pink and white flowers are visited in succession and at random, but neighbouring plants of different species, bearing flowers of the same hues, are avoided.

EXTENSIVE areas of floating oil off the east coast of Scotland have caused the death of enormous numbers of guillemots, razorbills, and puffins, and a considerable number of eider-ducks. Details as to this extraordinary occurrence appear in the *Scottish Naturalist* for September. Lady Erskine reports that on June 22 at Kingsbarns the rocks were covered with a thick, brown oil, some seven inches deep in the crevices. Dead birds were lying all along high-water mark, and large numbers in a dazed condition, and, with their feathers matted together with oil, were sitting about. Some eiders were also found in a similar pitiable plight. The keeper of the Isle of May lighthouse, on June 16, found birds similarly coated on the rocks, and unable either to fly or swim. Large sheets of oil drifted to the island, and all the creeks on the east side were full of it. The Misses Rintoul and Baxter on June 29 found hundreds of dead guillemots, razorbills, and puffins, and some eiders, on the shore at Cambo. They also report further victims from Largo

Bay and round the shores of Fife. In all these cases the birds were unable either to fly or dive, and hence died of starvation. So far no explanation of this floating oil has come to hand. Probably it escaped from a torpedoed ship bearing a cargo of lubricating oil.

THE current number of the *Quarterly Journal of Microscopical Science* (vol. lxi., part ii.), though considerably diminished in size, contains some very interesting matter. Mr. E. S. Goodrich's article on the chorda tympani and middle ear in reptiles, birds, and mammals should be welcomed by all students of comparative anatomy. In these days of embryological hair-splitting it is refreshing to find that he is able to give a whole-hearted adherence to the much debated theory that the stapes and columella are derived from the hyoid arch, while the incus and malleus correspond to the quadrate and articular respectively. The attention of teachers may be directed to some extremely useful diagrams contained in this memoir, especially text-figure 2, showing the relations of the auditory ossicles and associated structures in reptiles and mammals. Another article in the same number, dealing with the placenta of a lemur, is from the pen of the brilliant Oxford embryologist, Dr. J. W. Jenkinson, whose recent death while fighting in the service of his country is so deeply to be deplored.

W. H. BROWN and D. M. Mathews, in the *Philippine Journal of Science* (vol. ix., Nos. 5 and 6, pp. 413–561), give the results of an elaborate study of the Dipterocarp forests of the Philippine Islands. At low elevations throughout the Indo-Malayan region, the important forests, capable of yielding an extensive supply of timber, are those in which the dominant trees belong to the family Dipterocarpaceæ. Forests of this class occur in the Philippines from sea-level to 2500 ft. elevation, and cover an area of 30,000 square miles. Different types occur, the ecological and silvicultural features of which are well described by the two authors, who give numerous tables of the rates of growth of the main species, and discuss at great length the most suitable methods of utilising the timber, which will ensure successful natural regeneration on the felled areas. Artificial replanting appears to be impracticable. The prevalent opinion that most of the woods of the tropics are very hard and heavy, and consequently only fit for ornamental uses, is not supported by these investigations. On the contrary, it is believed that enormous supplies of soft and light timbers, just as suitable for building purposes as the pine and spruce of northerly regions, will eventually be procured from the tropical Dipterocarp forests, which often consist of dense stands of a few species, that may be logged at a small cost. An export trade in such timber from the Philippine ports has lately been rendered possible by the introduction of cheap American machinery.

THE last issue (1913–14) of the *Bulletin Hydrographique*, published in Copenhagen by the Conseil permanent international pour l'Exploration de la Mer, contains physical observations taken, chiefly in the North Sea, from July, 1913, to June, 1914. The volume includes an admirable series of finely executed maps illustrating salinities and currents, the former in the North Atlantic as well as the North Sea. The current observations are discussed at some length, but the available data are still insufficient to allow laws to be formulated with regard to mean current conditions. Unfortunately, the war has interrupted this international effort, but it is to be hoped it will be continued later. At most stations measurements have been made at 10 metres' depth and near to the bottom, and at fortnightly intervals for three years. The tidal current seems to be least in the Skagerak and the northern central part of the North Sea, greater in the vicinity of the coasts and in the eastern and western parts, and greatest in the southern portion between the Channel and 53° N.

IN *Naturen* for July and August, 1915, C. F. Kolderup discusses and illustrates the Devonian flora of Vestland, between the Nordfjord and the Sognefjord of Norway, on the basis of his researches from 1899 onwards, aided by material in the University collections at Kristiania. The plant-remains confirm the older suggestions as to the age of the sandstones and conglomerates, and the presence of the Orcadian *Thursophyton milleri*, which is probably a Lycopodiale, suggests a Middle Devonian horizon.

DISCUSSIONS of the anemographic observations recorded at Deesa from January, 1879, to December, 1904, and at Karachi from January, 1873, to December, 1894, by W. A. Harwood, are given in vol. xix. of the Memoirs of the Indian Meteorological Department; the discussions are numbered respectively VII. and VIII. There is an introduction by Dr. G. T. Walker, and descriptions are given of the two stations. The year at Deesa is divided into three seasons: the cool season, October to February; the hot season, March to May; and the rainy or south-west monsoon season, from June to September. As each season has its characteristic winds, the data are discussed under the three divisions. At Karachi the year is divided into similar seasons, which embody similar months to the discussion at Deesa. The greatest air movement at Deesa corresponds to the direction of maximum frequency throughout the year. It is north-east in the cool season, and shifts round through west during the hot season to south-west in the rains. At Karachi the predominant movement and the highest velocities are recorded from south-westerly directions at all seasons. The hourly velocities and co-ordinates of wind movement are given for each month for each of the two stations, and there are monthly wind-roses and other diagrams.

WE are glad to see that the war has not interfered with the publication of that very useful periodical, the Journal of the Royal Microscopical Society. In addition to the usual summary of current researches, the August number (part iv., 1915) contains an interesting article by Mr. Charles Singer on the "Dawn of Microscopical Discovery," with reproductions of some microscopical drawings of early date and portraits of some of the pioneers of microscopical science. According to the author, the pioneer period, with which his article exclusively deals, terminated about the year 1660, and was succeeded by the classical period, in

which flourished the great microscopists Hooke, Grew, Malpighi, Leeuwenhoek, and Swammerdam. Amongst the pioneers themselves are included such well-known names as Fabio Colonna, Galileo Galilei, Federigo Cesi, and Athanasius Kircher.

THE June number of *Terrestrial Magnetism and Atmospheric Electricity* contains the results of the measurements of the deviation of the magnetic compass from true north made on the magnetic survey ship *Carnegie* during her voyage from Brooklyn to Honolulu *viâ* the Panama Canal in the spring of this year. The corrections to the British Admiralty Chart are very small over the course from Brooklyn to the West Indies, but in the neighbourhood of the passage between Dominica and Porto Rico the chart gives the westerly deviation more than a degree too small. Across the Caribbean Sea the chart is within a few tenths of a degree of the Carnegie results, but in the first 30° of the course across the Pacific our charts give the easterly deviation about a degree too small. At greater distances from the American coast the error falls to one or two-tenths of a degree, and is sometimes an excess, sometimes a deficit, in the easterly deviation.

IN the Journal of the Franklin Institute for September, Mr. W. S. Bartholomew, president of the Locomotive Stoker Company of Schenectady, says that under average conditions any locomotive, freight or passenger, which has a maximum tractive effort of 50,000 pounds, or burns 4,000 pounds or more of coal per hour for an extended period, one hour or more, should be fired by mechanical stoker. It appears that about 1,200 locomotives in the United States have had mechanical stokers fitted, and about one thousand of these were in use in April last. Some six hundred are Street stokers of the over-feed type, and 365 are Crawford stokers of the under-feed type. It is claimed that the mechanical stoking of locomotives raises the efficiency of the locomotive by increasing the earning power, and also raises the efficiency of labour by making it possible for one crew to handle more traffic per train unit, or the same train unit with greater ease. It also lessens the arduous physical labour of the fireman, and lifts the grade of his employment.

THE *Engineering Magazine* for September contains the first of a useful series of articles by Prof. J. C. Smallwood on recording power plant operations. Descriptions are given of coal meters, feed-water meters, and steam-flow meters; these are thoroughly well illustrated from photographs and working drawings, and contain much information of value to engineers. Coal-weighing apparatus may be classed as registering meters, automatic coal scales, and hand-adjusted weighers. It does not appear that there is any autographic coal meter on the market, although it would appear that such a one would be of distinct use, especially in connection with mechanical stokers. Among water-flow meters, the V-notch weir meter has recently found much favour, as it may be combined with a feed-water heater. Other water-meters described are operated under the Pitot principle, the Venturi principle, and the principle of volume measurement in tanks. Steam-flow meters applied to individual boilers show the instantaneous steaming rate. A meter attached to each boiler of a battery of boilers will show if any boiler is "loafing." The Pitot and Venturi principles are also made use of in steam-flow meters. In the St. John meter the flow takes place through an orifice in which is a conical plug. A difference of pressure of about 2 lb. is maintained. When the flow increases the plug rises, and thus gives an increased area of orifice. A lever system connects the plug to the recording pen.

THE forthcoming books of the *Oxford University Press* include:—The Cures of the Diseased in Remote Regions. Reproduced in facsimile from the original issue of London, 1558, with introduction and notes by C. Singer; Origin and Meaning of some fundamental Earth Structures, by C. P. Berkey; Contributions to the Ethnology of the Salish Tribes, by J. A. Teit; Architectural Acoustics, by W. C. Sabine; Scientific Management, by C. B. Thompson; The Evolution of Modern Medicine, by Sir W. Osler; Geography of Eastern Asia, by D. Paton. *Messrs. Crosby Lockwood and Son* announce, in their "Manuals of Chemical Technology":—Chlorine and Chlorine Products, by Dr. G. Martin, with a chapter on Recent Oxidising Agents, by G. W. Clough; Sulphuric Acid and Sulphur Products, by Dr. G. Martin and J. L. Foucar; The Salt and Alkali Industry, by Dr. G. Martin and S. Smith, with chapters on the Stassfurt Industry and Potassium Salts, by F. Milsom. Further books of science to be issued by the *Cambridge University Press* are:—A Student's Book on Soils and Manures, by Dr. E. J. Russell, illustrated (Cambridge Farm Institute Series); Archæological Excavation, by J. P. Droop (Cambridge Archæological and Ethnological Series); Ticks: a Monograph of the Ixodoidea, part iii., the Genus Hæmaphysalis, Bibliography of the Ixodoidea, ii.; North America during the Eighteenth Century: a Geographical History, by T. Crockett and B. C. Wallis, illustrated; Cambridge Elementary Arithmetics, by J. H. Webster, Teacher's Books V., VI., and VII.; A First Course of Geometry, by Dr. C. Davison; Experimental Physics: a Text-book of Mechanics, Heat, Sound, and Light, by Dr. H. A. Wilson, illustrated (Cambridge Physical Series); An Introduction to Applied Mechanics, by E. S. Andrews, illustrated (The Cambridge Technical Series); Ships, Shipping, and Fishing: with some Account of our Seaports and their Industries, by G. F. Bosworth, illustrated (Cambridge Industrial and Commercial Series).

A CATALOGUE of books and papers on economic zoology and other subjects just issued by Messrs. J. Wheldon and Co., 38 Great Queen Street, W.C., contains the titles of many works of interest to naturalists. We notice that complete sets of reports and other publications difficult to obtain are offered at reasonable prices, and also rare works on fish and fisheries, marine biology, and economic entomology. Librarians and private workers who consult the catalogue will find in it a number of volumes well worth purchasing.

OUR ASTRONOMICAL COLUMN.

A NEW COMET.—A Copenhagen telegram reports the discovery of another comet by Mr. J. E. Mellish. In addition to the signatures of Profs. Pickering and Strömgren, the message bears the name of Aitken, and the position of the object appears to have been measured at Lick. Thus there are sufficient grounds for presuming an authentic comet has been detected, although the communcation contains no information regarding the movement (or magnitude) of the object. Its position on September 19 16h. 19m. 2s., Lick time, was R.A. 10h. 37m. 54s., dec. 26° 13′ 17″, *i.e.* between 40 and 41 Leo Minoris.

With reference to the note in this column last week, readers who have not the opportunity of consulting Dreyer's Catalogue may be interested to learn that N.G.C. 2261 is therein stated to show a cometic nucleus.

THE VARIATION OF LATITUDE.—Two papers in recent numbers of the *Astronomische Nachrichten* bear on this subject. In No. 4811 Dr. E. Przybyllok publishes results of an investigation into the effect on latitude determinations of that part of the atmospheric refraction due to the air inside the observatory differing in temperature from the external. It is found that measures of the altitude of the pole show a daily fluctuation in magnitude varying directly with the altitude of the sun. Among the numerous citations—there seems to be no reference to the work of Mr. S. Shinjo—one significant item concerns a systematic difference amounting to 0·11″ found between visual and photographic determinations caused by the heating effect of a small dark-room lamp fixed to the south of the photographic zenith sector.

In No. 4812 von B. Wanach discusses the Kimura term "z." Dr. de Sitter's view is adopted that the greater part of this term is due to the method of reduction. Refraction anomalies are considered to be a sufficient cause for the remaining part. The "z" term having been hypothesised out of existence, the attempt is made to modify the group corrections as obtained by the "Kettenmethode," so that in the mean "z" vanishes for all stations and years. To this end a modified "z" is taken as a negative declination correction, and new values are derived for the group corrections for the six northern international stations. The differences between successive groups show an annual oscillation having a maximum in spring and a minimum in autumn, whilst the amplitudes for the three Continental stations markedly exceed those at the "maritime" situations, thus indicating the probability that variations of zenith refraction of meteorological origin are operative.

STELLAR PROPER MOTIONS DETERMINED STEREOSCOPICALLY.—Quite recently M. Comas Sola, of the Barcelona Observatory, recorded some qualitative observations of stellar cross-motions obtained by stereoscopic comparison of stellar photograms (this col., August 26). According to the *Astronomische Nachrichten* (No. 4811) it now appears that Prof. Max Wolf has employed the stereoscope most successfully in quantitative determinations. Results are given of measures of the proper motions of eight stars in the neighbourhood of σ Leonis made on plates secured with the 16-in. Bruce telescope at an interval of 12·108 years, one of the plates having been taken in 1903, the other in the early part of the present year. The stars measured range from 7·0–12·5m. magnitude, and the yearly motions vary from 0·31″ to 1·18″. Some of the stars have been measured previously, *e.g.* the pair 83 Leonis by Kobold among others, who found the annual motion of 0·77″, whilst the new method gives 0·74″ for the same quantity.

ROTATION PERIOD OF NEPTUNE.—Mr. Maxwell Hall has published (Monthly Notices R.A.S., vol. lxxv., No. 8) the results of photometric observations of this planet made during its recent opposition; thirty-five measures of magnitude were obtained during the period February 26 and May 10 of the present year. The magnitude ranged from 6·87 to 7·76, and the period which best fitted the measures was 7h. 50m. 68s. Similar observations made during November, 1883, gave a period of 7h. 55m. Greater continuity in the series of observations is necessary, and the co-operation of observers well distributed in longitude is therefore invited.

THE INTERNAL CONSTITUTION OF THE EARTH.—Mr. Harold Jeffreys, who has recently published several important theoretical investigations on the physics of the earth and moon (Mem. R.A.S., vol. lx., part vi., and Proc. R.A.S., vol. lxxv., No. 8, pp. 648–658), contributes a very useful article to the current number of the *Observatory* on the mechanical properties of the earth. A good idea is given of the manner in which a number of apparently widely differing lines of investigation have in reality converged in adding to our information—albeit at times in a somewhat conflicting fashion—regarding the state of the earth's interior.

PHOTOMETRIC OBSERVATIONS OF δ CEPHEI.—During the period June 10–September 26, 1914, Dr. Giuilo Bemporad and Dr. V. Fontana collaborated in making a fairly numerous series of photometric measures of the light of this star. Dr. Bemporad's results appear in the *Mem. Spett. Ital.*, June, 1915. The mean light curve shows a secondary maximum, and at a later phase an inflection. A further analysis of the data was made with special reference to the secondary oscillations.

THE EVOLUTION OF THE STARS AND THE FORMATION OF THE EARTH.—The second course of lectures on the William Ellery Hale foundation was given at the meeting of the National Academy of Science at Chicago last December by Dr. W. W. Campbell under the above title. These lectures are now being published in *The Popular Science Monthly*, beginning in the September number.

THE ETNEAN EARTHQUAKES OF MAY, 1914.

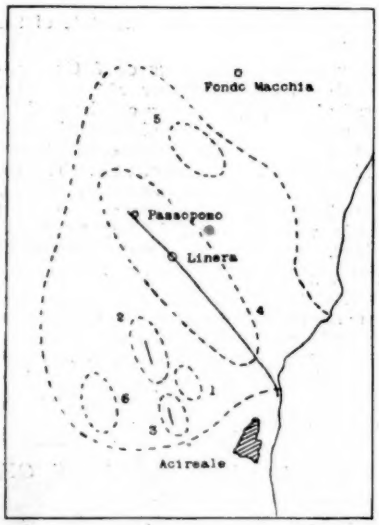
THE term *volcanic earthquakes* has for long been applied to all earthquakes originating within the bounds of active or dormant volcanoes. Such earthquakes are usually distinguished from ordinary tectonic earthquakes by their small disturbed areas, the great intensity of the shocks near the centres of those areas, the brevity and abruptness of the shocks, and the comparative absence of fore-shocks and after-shocks. While the countless tremors which precede and accompany volcanic explosions are no doubt the effects of such explosions, it has been assumed, perhaps rather hastily, that all volcanic earthquakes are as intimately connected with the volcanic operations. Several recent investigations (see NATURE, vol. xcii., pp. 716–7; vol. xcv., p. 215) have, however, shown that many volcanic earthquakes are of a tectonic or semi-tectonic character, and that both earthquakes and eruptions are in all probability effects of the same cause or causes.

The more important Etnean earthquakes evidently belong to this category. They originate beneath the volcano—in recent cases, below its eastern flank—and they are closely associated in point of time with explosions or periods of increased activity of the volcano. Moreover, their seismic foci are at a slight depth. On

the other hand, the meizoseismal areas are much elongated and their longer axes are directed roughly towards the central crater and at right angles to this direction, implying that they are probably due to slipping along radial and peripheral fractures (see NATURE, vol. xciii., pp. 272–3).

The earthquakes of May, 1914, on the eastern flank of Etna, supply useful evidence on this subject. They have been studied with great care by Prof. Gaetana Platania,[1] who, with ample materials at his command, confirms the conclusion arrived at in the last-mentioned paper. Several of the shocks, besides the principal earthquake of May 8, were of destructive intensity, and the outer broken line on the accompanying map includes all the places in which houses were damaged by the different shocks.

Slight earthquakes were felt within this area on April 28 and 30, and May 1 and 2. The series proper began on May 5. On May 7 at 5.35 p.m. (G.M.T.) there was a strong double shock, the two parts being separated by an interval of three to four seconds. In the epicentral zones, indicated by the curves Nos. 1 and 2, walls were cracked and some houses damaged.



This may, as Prof. Platania suggests, have been a twin-earthquake, but the evidence is insufficient to decide the point. Soon afterwards, at 9 p.m., another strong shock caused slight damage within the area represented by the curve No. 3.

On the morning of May 8, only light vapours were being emitted from the central crater of Etna and from the vent on the north-east flank opened in May, 1911. At about 5.30 p.m., however, extraordinary activity was manifested in both, and this continued for several days with a first maximum on the evening of May 10, and activity above the average for the rest of the month.

Shortly afterwards, at 6h. 1m. 30s. p.m., occurred the principal shock of the series, by which the towns of Passopomo, Linera, Cosentini, Carico, and Mortara were destroyed. The meizoseismal area is an elongated ellipse (No. 4), about 6 km. long and 2 km. wide. There was also a detached area of somewhat less destruction (No. 5). Within the meizoseismal area not only were the houses ruined, but the ground itself was crushed. A slightly sinuous fracture traverses the axis of this zone, as shown by the continuous line in the map, and in its neighbourhood the ruin was complete. Throughout its course there is almost everywhere a change of level, in some places of a few centimetres only, in others of as much as 40 centimetres or more, the ground on the north-east side being depressed relatively to that on the south-west side. There are also traces of a slight horizontal displacement.

Between May 8 and June 4 thirty after-shocks were recorded, only one (that of May 28) being of any importance. The meizoseismal area of this shock is indicated by the curve No. 6. Prof. Platania notes that there were other migrations of the epicentres besides those noted above. He concludes that, during this seismic period, the whole eastern flank of Etna was disturbed, probably by subterranean movements of the magma, which were responsible both for the increased activity of the volcano and for the slips along radial fractures which resulted in the earthquakes.

C. DAVISON.

[1] Sul periodo sismico del maggio 1914 nella regione orientale dell' Etna, *Publ. dell' Ist. di Geogr. Fisica e Vulcanologia della R. Università di Catania*, No. 5, 1914. Pp. 1–48.

METEOROLOGY WITHOUT INSTRUMENTS.[1]

THOSE who have been compelled to wade through the long-continued record of meteorological observations know and dread the serried columns of figures that tell of the scrupulous care with which the conscientious observer has read his barometer and thermometer. As a rule, it is impossible to inspire the mechanical and lifeless record of the weather of the past year, or of the past decade, with any lasting interest, but Mr. Backhouse, departing from stereotyped methods, has given us a book on climatology that does not weary by its monotony or tire by its endless repetitions.

Much of the success and charm of this volume depends upon the fact that it is a human document, recording what has been seen and experienced, not what is automatically registered by ingeniously devised instrumental methods. It is a revelation of character as well as an inquiry into the variation of climatic factors. This record goes back to the time when the author was a schoolboy at York, and demonstrates the value of habits of accurate and intelligent observation, diligently preserved through life. With perseverance and practice has come an acuteness of perception that has made Mr. Backhouse one of the most successful observers of those minute differences in the appearance of the sky or of the atmosphere that escape untrained observers, who prefer to consult the barometer rather than natural phenomena. And with the increased capacity for observation has come apparently the greater opportunity for exercising it. To most people, the observation of such phenomena as lunar rainbows or parhelia is a rare event, and without such a trustworthy record as we have here, many would be inclined to doubt their frequency. Take again such instances as the successive alternation in the wind direction, known as "land and sea breezes." Although the cause is operative all over the world, we have come to regard these winds as confined mainly to a few tropical localities, and believe that it would be vain to attempt their observation, except in these favoured spots. But Mr. Backhouse shows how the attentive observer can study the behaviour of these alternating breezes on our own coast, and even mark the varying direction, as the azimuth of the sun, at rising and setting, changes at different

[1] Publications of West Hendon House Observatory, Sunderland. No. iv. Meteorological Observations, chiefly at Sunderland. By T. W. Backhouse. Pp. v+188. (Sunderland: Hills and Co., 1915.)

seasons of the year. More important than the record of the facts themselves is the consciousness of how much we miss from failing to cultivate methodical habits of observation.

The manner in which the information is presented and made available adds to the interest attaching to the method of collection. The author sums up his accumulated records, extending over forty years or more, in diagrams, that appeal to the eye. Wind-roses are a familiar device for exhibiting frequent and lawless changes. Similar contrivances are largely used, and demonstrate clearly that the north and east winds grow in frequency as the year advances towards the summer, to be followed later by the increase in the west winds, through the autumn and early winter. The land and sea breezes are similarly treated, and the diagrams are equally instructive. The dependence of rain on wind is also illustrated diagrammatically, and the resulting figures are deserving of close study. The chapter on the prevalence of fog and mist, as determined by the visibility of prominent objects, is of special interest, for it is a kind of observation that cannot be assisted by instruments, but depends solely for its accuracy on the skill and vigilance of the observer, qualities in which Mr. Backhouse excels.

THE BRITISH ASSOCIATION.

SECTION G.

ENGINEERING.

OPENING ADDRESS[1] BY H. S. HELE-SHAW, D.Sc., LL.D., F.R.S., M.INST.C.E., PRESIDENT OF THE SECTION.

THE preparation and delivery of a presidential address is usually a pleasant and not difficult task, although it seems to be the custom mildly to intimate to the contrary. In ordinary times the president chooses a subject on which he has done some work, and with which he is therefore familiar, and with which, moreover, his name is more or less associated. If this had been an ordinary time, I should have liked to deal with the fascinating subject of mechanical locomotion, and to review what has taken place, let us say, since the meeting of the British Association held in Manchester rather more than half a century ago. But the time is not an ordinary one, for the war which a year ago cast its shadow over the meeting of the British Association in Australia has, as the months have passed by, gradually unfolded the most terrible page in the history of the world.

It is terrible not merely because of the frightful slaughter which has taken place and which will yet take place, owing on one hand to the gigantic armies employed, and on the other to the nature of modern warfare. A predecessor in the chair, one who has left many marks of his genius on the peaceful engineering works of the country, Mr. Hawksley, commented about fifty years ago on "the unhappy necessity of devoting so much of the science and skill of members of the association to the defence of the homes of the people of this great nation."

This is not the place to dwell at any length on the subject of the war; but I cannot help pointing out that the whole attitude of scientific and professional men in this country at the beginning of the war shows how little they realised the real nature of what was before us; but we now know that the only way to escape from destruction ourselves is to employ all the resources of science in our own defence.

It is partly on these grounds that the meeting of the British Association for the Advancement of Science has been held this year, because science is proving such an all-important factor in the present war.

The mere holding of this meeting, however, with a vague sort of idea that science is associated with war, does not seem to most of us to meet the real needs of the case. The decision to hold the meeting was made in March, *i.e.* six months ago. Since that time the nation has awakened to the fact that matters have become very much more serious, and we scarcely needed the solemn warnings of our responsible statesmen to enable us to realise this. We see our foe turning every resource towards the active prosecution of the war, and bringing in the aid of every man towards that end. If the result were a small matter, we might pursue our way, as we did at first, with the fatuous cry, "Business as usual"; but day by day it is brought home to us that the Hymn of Hate, childish though it may seem, really represents the serious mind and deadly intention of our enemy. It behoves us all then who are members of it to show that the British Association, which has rendered such great services to the country in the past, can bear its share of the burden to-day.

I assume that we are all agreed upon this point, and it remains to consider the best way in which such a work can be carried out. Understanding from the president that he is dealing with the question from the point of view of the whole association, I need only deal with the matter so far as it concerns our section. After discussing the matter with our secretary and several of my predecessors in the chair, I suggest that we continue the three research committees already in existence, but do not institute a fresh one, forming instead a special committee, the purpose of which I propose to lay before you. Before doing this, I should like to point out that the very fact that engineering constitutes such an important feature of the war has prevented our having, as often in times past, papers on military and naval subjects, such as warships, armour, projectiles, etc. And this for two reasons: first, because nearly every professional or manufacturing engineer having as a rule sent the best of his staff to the fighting line is overwhelmed by actual work either directly or indirectly connected with munitions and war material, and is much better so employed than in talking about the subject, or even in attending the present meeting; secondly, because men who really know all about such work would not be likely to discuss it in public at the present time, and I am sure you will agree with me that we do not want merely popular science on war subjects.

Hence, the twenty-four papers before the section deal with engineering science generally, but I venture to think they are of a high scientific quality, and quite as important in character as those of former years; and, although I need hardly remark that our report on gaseous explosions does not, as suggested by a daily paper, relate to high explosives, it will be noticed in several cases the papers touch closely on subjects bearing on the war, such as those on wireless telegraphy and the traction of artillery.

The object of the proposed committee is twofold. The first of these would be to undertake any work which may be of use in an advisory capacity or by research, or indeed in any other way for direct assistance in the war. This would, of course, be a temporary object of the committee, but nevertheless a real one. I need not go into all that may be done in this direction by the committee, but one step will be to place ourselves at the service of the Ministry of Munitions for such work.

With regard to the second purpose, the matter stands on a rather different footing. We were in many respects quite unprepared for the war on which

[1] Abriged by the author.

we have entered, and though this offers one of the most powerful arguments in refutation of the charge that we deliberately entered the war for sinister purposes, it will be very disastrous if we repeat our unpreparedness when the war ceases, and we shall deserve the worst that can happen to us. When peace is concluded, it will only be a prelude to another war, and a war which will recommence with far greater energy on the part of our enemy than before—viz., the war of commerce—and the latter will be almost as serious for us as the more sanguinary one.

Remembering how soon we forgot that black December week fifteen years ago; and the lurid indication from the German Emperor that he and his people had the will to destroy us then if not the power, and how swiftly we relapsed into national ease at the end of the Boer War, it behoves every man who can do so to take his share in making ready for the terrific struggle Germany is certain to put up in the arts and manufactures. I might give evidence of this from a number of sources, but I will only take one emanating from a body of professors of the great universities of Germany. These gentlemen have published a voluminous manifesto containing, amongst other gems, the following:—"Once the Russians are driven back beyond their new Frontier we shall not forget the war which England has made on the maritime and Colonial commerce of Germany. That must be the guide of our action and we must supplant the world trade of Great Britain. By her blockade of Germany, England has instructed us in the art of being a European Power, militarily, industrially independent of others. We must immediately seek to create for ourselves apart from the Empire of the Seas a Continental commercial enceinte as extensive as possible." It does not, however, want such published evidence to convince any practical person of the folly of thinking that a keen and virile nation having more than 100 million inhabitants is going to be crushed out of fierce and vengeful competition, whatever the end of the war may be. We shall better appreciate what this competition will mean if we consider the progress made by Germany during the last half-century in the arts and manufactures. (The president then gave curves showing the comparative growth of Great Britain and Germany during the last fifty years.)

The above curves are quite sufficient to illustrate the marvellous progress of Germany; and in passing I may remark that one of the most persistent allegations which has been repeated *ad nauseam* by German statesmen, soldiers, professors, and the whole German Press generally, is that the war is caused by our jealousy of this progress. Perhaps you will consider it waste of time even to allude to this matter; but I will take this opportunity of pointing out that if there had been any truth concerning this jealousy, it would have been the simplest thing in the world to shut Germany out of a large number of markets in the British Empire, and that this would have been a very much cheaper process than going to war. Our Colonies, which are now fighting equally with ourselves against German aggression, made a very small difference (5 per cent., for instance, in the case of New South Wales) in regard to the introduction of German manufactures. I myself have somewhat close knowledge of two colonies, and I cannot help recalling the astonishment with which I found in South Africa that, when there was a huge scheme of electrification effected, the enormous amount of material which Germany supplied was for what the public mostly believed to be a purely British enterprise. I also have reason to know that the supply of machinery to New South Wales from Krupp in some cases exceeded by as much as ten times in amount the quantity supplied by British firms. The prices were no higher, in spite of the 5 per cent. advantage to this country. The delivery of the goods was, on one hand, sometimes inordinately delayed, though scrupulously punctual in delivery on the other.

Now, when we look closely into the causes of Germany's great advance, we can learn lessons which we have been culpably slow to take to heart. Although there are other causes, first and foremost, and overshadowing all others, is the determined and wholehearted organisation of German industry. I see it recently stated that the scheme above referred to (the Victoria Falls scheme) was lost to this country because the industrial banks of Germany backed their own manufacturers, and this is no doubt partly true. As I have already quoted, Germany's power in war is admitted to be her mechanical organisation, and the organisation of every material and engineering force to that end. Just as striking, if not more so, is her organisation for the arts of peace, and I lately heard a very shrewd man of affairs express his amazement at Germany's entrance into war, when by peacefully pursuing the way she was going she would have dominated the world commercially in a few years' time. It is undoubtedly in the matter of scientific organisation even more than the organisation of science that Germany has achieved such wonderful results, and it is therefore in this direction that we must leave no stone unturned if we wish to have any chance of holding our own in the future. I will indicate a few of the matters in which there is ample scope for doing useful work in the above direction.

Education.

A sign of the times is the inclusion of an Education Section in an association for the advancement of science. This has not been done on the narrow ground of improving the teaching of science in schools, but because it is now recognised, and this none too soon, that the whole problem of education must be treated in a scientific manner.

When the subject of engineering education is mentioned we are apt to think only of the training of such engineers as have been considered in a recent report issued by the Institution of Civil Engineers, and to exclude, as that report purposely does, the training of our artisans and foremen. We certainly do not connect the idea at all with the training of the artisan himself. As a matter of fact, while high scientific training of the professional engineer and manufacturer is of vital importance, the proper education of the men whom he will have to control is scarcely less so. The latter education may not be of the same kind, but it is just as vital to the country, and its present condition is a serious evil.

A well-known American, in the *General Electric Review*, writing on the "individual and corporate development of industry," points out that theoretically the aim of both employer and employee is the same, namely, the efficiency of industrial production to increase the return of the investment in labour and in capital. Unfortunately, however, as he remarks, "the relations between the two have frequently been hostile industrial warfare over the distribution of the returns rather than co-operation for the increase of financial returns of both parties."

One of the most humiliating things of the present war has been the mutual relation of the two in this country in what is probably the most critical period in our history. I will say more later on this subject, but there is no doubt the subject of industrial education needs earnest consideration.

(Various matters connected with the education of engineers were then dealt with.)

Research.

If there is one thing more than another which the British Association can be congratulated upon, it is the work which it has done in the matter of research, and it is very interesting to go back to the earliest days, more than eighty years ago, and to see how, in very different days from the present, research in all branches of science was encouraged, and what a potent factor the various meetings have been, not only in actually fostering the work of research itself, but in obtaining the recognition which is accorded it to-day. Amongst other things, the National Physical Laboratory stands largely to its credit, as having been first powerfully advocated at one of its meetings. This section has not been behind the others, and at the present moment there are three research committees, viz., those on gaseous explosions, compound stress, and impact. The work of the first of these is so valuable that its results have been published all over the world.

To-day there is a more general recognition of the importance of research, and the recent institution by the Government of a Committee for the organisation and development of scientific and industrial research is the latest indication that the nation is beginning to realise its importance.

So far from all this making our work less necessary, there is all the more reason why we should have a permanent Committee of Research, because one of the intentions of the new Government Committee is to utilise the most effective institutions and investigators available, and the statement is made that one of the objects of the Government Research Committee is to select and co-ordinate rather than originate, and that one of its chief functions will be the prevention of overlapping between institutions and individuals engaged in research. The Government Committee in question is only dealing with the organisation in England, Wales, Scotland, and Ireland. Now, the great advantage possessed by this association is the fact that it includes not only Great Britain and Ireland, but all the Colonies, and indeed one of the three researches above-mentioned is being carried out in Australia. Another research of the association is being carried out in Cyprus; and work is also being done in such places as Jamaica and Egypt. It is more important therefore than ever that the British Association work in research should go on, as, since its members are drawn from all parts of the British Empire, its influence should be correspondingly great.

(The president then dealt with various aspects of research specially relating to engineering.)

Standardisation and the Metric and Decimal System.

One of the favourite gibes at this country is our supposed utter want of system in regard to our standards and systems of measurement generally. With regard, for instance, to the decimal system, it is frequently stated that thirty or forty countries have adopted the metric system, while only three retain the inch as a standard. It must be remembered, however, that the population and wealth of the three latter are at least equal to, if not greater than, all the others, though this does really not prove anything, except the difficulty of the subject, and that there is a great deal to be said for both sides. In the report of the Decimal Association last April, the hope is expressed that one of the changes for the better arising from the war will be a reform of our weights and measures. No class of the community would be affected more closely than the engineer, and engineers cannot fail to be interested in the question as to whether the general and immediate adoption of the metric system would or would not be a valuable means of assisting British firms in their competition with Germany and Austria, in countries where that system is in vogue. Although it is very unlikely that a wholesale change is imminent, it is certain that the metric system is gradually spreading, and in the United States and Australia very strong forces are on foot to bring about a change to that system. The British Association has over and over again had the subject before it, and our committee might be of service in making a report on the present state of the matter.

One thing is certain: the committee might be of assistance in recommendations which would bring into line all British engineers in duplicating tenders for countries which have the metric system.

Coming to standardisation, here we have more ground for satisfaction. The Engineering Standards Committee during the last ten years has done a work which is quite equal to that in any other country, of completing standardisation of all important matters in engineering, and, moreover, has secured the recognition of these standards in all public contracts.

There is yet work to be done, however, and one matter of great importance would be to get a universal standard of temperature for instruments of measurement other than zero. A temperature, for instance, of about 62° Fahr. would make steel rods' measures more practically workable than at present.

In connection with the subject of temperature and standardisation, I recently came across a statement by the general secretary of the International Electrotechnical Commission (*Journal*, January, 1915) that the want of uniformity in the rating and testing of electrical machinery has been a serious evil, and he goes on to say:—"The German standardisation rules, for instance, which, through well-organised and combined effort on the part of the German makers, had previous to the war become widely recognised on the continent of Europe as well as in many countries to which British machinery is exported, by permitting a higher temperature rise than is considered good technical practice in Great Britain, certainly have not assisted the British maker in foreign markets."

Exhibitions and Museums.

In recent years a large number of commercial exhibitions have been held of all branches of machinery, and it is satisfactory to note that one of the features of such exhibitions has been the holding of scientific lectures, and the inclusion of the exhibition of scientific instruments and apparatus, and also exhibits showing the relation of scientific experiments to engineering work.

(Here follows a number of practical suggestions on this subject.)

Patents and Patent Laws.

This subject is well worthy of the consideration of the proposed committee, since progress in engineering, certainly on the mechanical and electrical sides, is largely dependent upon invention, which is not likely to be seriously undertaken without adequate protection, not entirely for the inventor, but also for those who really make the invention practical by means of capital and business support. A great deal of nonsense is talked and written about inventors, as if they were a special class of being, generally mad and always impossible. Some inventors are both, but the fact is, most engineers spend their lives seeking new ideas and devising new methods of carrying them out, in short, in inventing. It is of the greatest importance that every step should be taken to encourage sound invention and to see that anything of value is secured for this country. Of course, every invention

worth anything is immediately known in other countries, but I need not argue to this section that the country which actually produces the inventions is at a great advantage quite apart from the royalties payable on foreign patents. The foundation of the Munitions Invention Panel is a step in the right direction and will doubtless be followed later on by Government Committees for peace inventions. Such Committees or Government Departments dealing with various industries will be assisted by suggestions from a body like this. Take, for instance, the present state of Colonial patents; within the last few years one Commonwealth patent has been made to cover the whole of Australia, instead of there being, as of old, separate patents with different regulations and fees for each separate Colony. South Africa has not yet conferred a similar boon upon inventors, and we might do something to expedite this desirable innovation. But this touches the much wider question of Colonial Patent Laws as a whole. These are all different and differ from those of the Mother Country. It would be a splendid thing if we could bring about a conference leading to unification of these diverse Patent Laws and have one comprehensive Patent Law for the whole Empire.

A matter in which the German system has certain advantages, is in having two classes of patents. One of these is the patent "proper," which is only granted after the most severe search and criticism and holds the usual period when granted. The other is a secondary patent granted for the shorter term of six years, and is given for one of the hundred and one minor improvements and devices which, though of real value, only constitute small modifications in detail and not new applications of principle.

(The president stated that he believed German patents were fairly granted to foreign applicants, but the common view to the contrary was supported by such statements as in the prospectus of the Deutsche Maschinenfabrik, which runs as follows:—"With the present-day competition every firm is compelled to protect its new designs by means of patents, *and watch that no other patents are granted* which would seriously effect (*sic* affect) it.")

There are other matters, such as the question of giving wider powers to our Comptroller to refuse a grant where novelty is less than microscopic. Here again the German system of demanding that some definite principle is applied *to produce some definitely new effect*, might to some extent be followed, especially in view of the constant accumulation of published devices, some patented and others not.

I will conclude this section, which is far from exhaustive, by pointing out what a debt of gratitude engineers and others owe to the Patent Office for the manner in which the work of producing illustrated abstracts of all patents has been, and is being, done, and the weekly issue of the *Patent Journal*, but this may be associated with the suggestion that it would be a real convenience if, instead of the delay which often occurs, the abstract appeared at the same time or immediately after the publication of the complete specification.

Organisation.

This, I venture to think, is by far the most important question of any I have raised, and I will go so far as to say that I believe it to be the all-important one, as it practically embraces the others. If you do not agree with me, I feel sure it is because we do not understand the same thing by the word "organisation." When you speak of organisation to most people they immediately seize upon some small feature which may be to them of more immediate interest. It may be the general arrangement of their accounts, their system of store-keeping, of dealing with their workmen, of the sales department, of fifty other minor details. If you take this narrow view of organisation you will, of course, at once say that a scientific man has very little to do with it, and indeed the manufacturer as a rule, thinking of his works organisation, scouts the idea that a man of science can either know or have anything to say about it which is of any value.

Let me therefore take the dictionary definition. To organise is to "arrange or constitute interdependent parts, each having a special function, act, office, or relation with respect to the whole." If we accept this definition, which as a matter of fact we must, there is no question as to the all-important nature of organisation, for you will notice there are two outstanding things. The first "interdependent parts"; and the second their "relation to the whole." Thus the subject of organisation really includes the whole of industry. It includes science and its relation to manufacture. It includes the relations between the employers and employee. It includes the workman, and his attitude towards new devices, labour-saving appliances, and output. It includes the whole question of the supply of raw materials, and even the sale and delivery of the finished article. Taking these different features, is there any doubt that the man of science in this country can hold his own, and more than hold his own, with that of any other? The history of invention is quite enough to give a final answer to this question. Again, the British employer and man of affairs has always shown himself individually in the forefront of enterprise; as for the workman himself, he is admitted, in the matter of intelligence, physical endurance, and skill, to have no superior; while with regard to materials for manufacture, and the power of delivering goods, it need scarcely be said that the British Empire, if we take it as a whole, is the richest country in the world in raw materials, and its means of delivery of its good is expressed by the enormous preponderance of its mercantile marine.

When we come, however, to these interdependent parts and their relation to the whole, it is there that we find the weak joint in the armour. It is in this respect that Germany can teach us a striking lesson in the *arrangement* of these interdependent parts with respect to the whole. From the top to the bottom the whole forces of their industries are so thoroughly organised that they get all that is humanly possible out of the various factors. I do not limit this merely to the wonderful organisation of any works, like Krupps, or the Deutsche Maschinenfabrik, or hundreds of other works, but I include the organisation of all the Government Departments, together with the banks, the railways, and the shipping, so that every facility is afforded for the world commerce of the German Empire.

This co-ordination in Germany is carried out in every industry in a way we generally have little idea of. For instance, the other day at a deputation to the Government, Mr. Runciman remarked that the difficulty of connecting the manufacturers with the commercial staffs in this country is deep-seated, but perhaps not altogether incurable. Further, that the manufacturer must realise what he can get from the universities, and the university must know what the works require. Dr. Forster, the treasurer of the Chemical Society, also said that "the Germans were so imbued with the need of pursuing modern and efficient methods of education, in applying science to industry, that they hold in contempt a country which notoriously neglects such processes": and he attributed this contempt as partly contributory to their cheerfulness in entering into the war with us.

Now while these remarks are undoubtedly true, they are only a part of the truth. The evil is far wider than in any special application, for, as the German knows perfectly well, there are innumerable individual cases of organisation in this country of equal efficiency to any in his country, and he is glad enough to learn from special cases. Let us take one, and I do so because it shows that the man of science is capable of industrial and manufacturing organisation, if he turns his mind to it. I refer to the case of the firm known as Barr and Stroud, Ltd. (A brief account is then given of the organisation of the foregoing works for constructing range-finders.)

Now I do not believe the Germans despise us for our want *per se* of the application of science to industry. I do not think they have much reason to; but what they do despise us for is the want of co-ordination, which I venture to say amounts to positive slackness, which they are keen enough to observe permeating the whole of this country. They see different sections, instead of being united for a common end, quarrelling with each other, filled with mutual suspicion and distrust, with apparently no common bond of union, and whereas the German is proud of the Fatherland, he sees in this country large numbers who seem, either through self-consciousness or ignorance, to be ashamed to mention the subject of the British Empire, or, what is worse, to acknowledge that any love of their country is or could be a mainspring and incentive to strenuous effort.

The other day, Field Marshal von Moltke stated, and there is no reason to disbelieve him, that great as was the storage of ammunition and shells before the war, the enormous demand far exceeded all expectation, and Germany found herself for a time in the same plight as her enemies, but he further stated that Germany's emergence "from this dangerous position was largely due to the extraordinary organisation, which included not merely the adaptation of their factories for munition purposes, but *capacity for work of the people*, and the *patriotic spirit of the German workmen*."

This brings me to consider what is probably the most serious feature in our national life to-day, which I have already alluded to under the heading of education, viz., the relation of employer and workman. It is hopeless, as long as such ideas prevail which seem to do at present, to think of any sound organisation of our industrial system taking place, because the interdependent parts are not arranged (and can never be arranged until we change radically) with respect to the whole. Now as one who has served an apprenticeship, who has taken his money weekly from a tin box with hundreds of other men, who has been a member of the Amalgamated Society of Engineers (in fact, was working as an engine fitter when a Whitworth scholarship made a college career possible), I am the last man to put this evil down entirely to the working man. I know individually he is just as capable of patriotism as any other class. Get him by himself, even the men whose strikes have caused such despondency in the minds of our Allies, and who have seriously jeopardised the very existence of the country, and you will find (except in the sort of case to be found in all classes of society), that he, as an individual, is willing to make sacrifices, and if necessary to give himself for his country. The truth is that the canker which is eating the heart out of our industrial life is due to an entirely wrong attitude of mind. (Various matters illustrating this point were then dealt with.)

The matter of labour disputes is so serious as to demand plain speaking. It must be admitted that there are many employers and companies which, to satisfy themselves and their shareholders, extort the largest possible dividends and pay the smallest possible rate of wages, and do so apparently without the slightest idea that the men and boys under them are capable of education and personal influence. Can it be wondered then that men under these conditions are willing enough to listen to the orator who merely appeals to their fighting instincts and join in the game of grab as against the employer? On the other hand, strikes have occurred when employers have honourably carried out their obligations and undertakings, and the men have shamefully departed from an agreement made by their chosen leaders, throwing over the leaders the moment they have fancied it to their own selfish interests to do so, and without a single thought of their duty to the community as a whole.

We have recently seen the Prime Minister and other leading statesmen struggling, sometimes in vain, to bring large bodies of men to a reasonable state of mind. Is not this (and I speak without the slightest reference to party questions) a case of Nemesis overtaking us for having in so many cases pandered to the selfish instincts of large bodies of men in order to secure their votes, instead of sternly telling them unpalatable truths?

There was recently an intensely interesting article by the late Prof. Friedrich Paulson, previously professor of philosophy in Berlin University, published in the *Educational Review* of New York. In this article, the subject of which was "old- and new-fashioned notions about education," he pointed out that the whole of our educational system was going wrong, and that we could not escape the conviction that a tendency towards weakness and effeminacy was its chief trait. His three mottoes were: learn to obey; learn to apply yourself; learn to repress and overcome desires; and he remarked with great truth under the first heading:—"He who has not learned to do this in childhood will have great difficulty in learning it in later life; he will rarely get beyond the deplorable and unhappy state that vacillates between outward submission and uproarious rebellion."

Is not one of the first things the reform of our educational system?

One of the tasks to which the British Association might bend its energies with the greatest benefit to the country, is to bring about a reform of our educational system, so that while we do not kill individual enterprise and freedom of thought, which have contributed so largely to the political organisation and constitution of the British Empire, of the value of which we have had such wonderful evidence from our Colonies and Dependencies during this war, we seek to implant in the minds of young and old those ideas of discipline and service to the State, the want of which so seriously threatens the successful organisation of our industrial life.

Conclusion.

In bringing my address to a close I hope I have made it clear that I have had throughout a practical object. Expressed briefly, it is that the service of every agency is wanted for definite work at this crisis, both in the actual war, and afterwards in the war of industry which will be waged with equal intensity in peace time. The British Association cannot be said to have undertaken as a whole a work of this kind, yet one finds a general desire on the part of every member that something should be done. With this object I communicated with the president, and found that both he and such of the officers as could be got in touch with were in entire sympathy with the general proposal, and advised that our section, like that of Economics, should start at once with a committee on

the subject. I have great hopes that such a committee will be formed, but I have no hopes of either our own subcommittee or the committee of the association as a whole doing any good, unless they are prepared with definite suggestions and advice which cannot be ignored and put aside. I have not the slightest faith in the mere formation of a committee which will content itself, let us say, with the mere offer of its services, even to a Government department, and the mere pious expression of certain opinions. If a committee does not want to become ridiculous, it must show that it is in earnest. To show that it is in earnest it must take care that its reports have a practical object, can be at once grasped by overworked Ministers and officials, and are of real value.

Fortunately the British Association is a powerful body with great traditions, and will be listened to if such work is carefully and energetically done. We can at least congratulate ourselves that whatever the evils of the war, the country as a whole has been moved from its usual attitude of self-complacency, and that the numerous new departments and organisations are showing a desire to utilise every force and agency for the service of the State, and to grapple with the great problem of its more efficient organisation. It will be no small work of a British Association committee if it can supply sound ideas and recommendations on the many thorny problems which must be solved. We cannot all of us be, as so many would like, in the fighting line, either in France or the Dardanelles, but we shall be just as deserving of contempt as those who have shirked their responsibilities, if we content ourselves with mere offers of service, and having as we think shelved responsibility by leaving initiative to others, we pass along our way sheltering ignobly behind those men and women who are doing their duty to their country.

SECTION H.

ANTHROPOLOGY.

OPENING ADDRESS[1] BY PROF. CHARLES G. SELIGMAN, M.D., PRESIDENT OF THE SECTION.

IT is impossible to pass to the subject of my address without first referring to the heavy losses which the Teutonic lust of power has inflicted upon our science, no less than upon every other department of humane and beneficent activity. Whatever loss we may yet be called upon to endure there can scarcely be any more regrettable than the death of Joseph Déchelette, whose acknowledged eminence makes any detailed account of his labours superfluous. His valour was no less than his erudition, for though his age exempted him from all military duties, he insisted on taking his place at the head of his old company of Territorials, and was killed last October while leading his men in a charge that carried the line forward 300 yards. We have also to mourn the death of Robert Hertz, a regular contributor to *L'Année Sociologique*, and of Jean Maspero, son of Sir Gaston Maspero, an authority on the Byzantine period and Arabic geography. The other men whose premature death we deplore belong for the most part to that brilliant band of French soldier-explorers to which African ethnography owes so much, and includes Captain René Avelot, whose name will be known to every reader of *L'Anthropologie*.

In my address I shall endeavour to outline the early history of the Anglo-Egyptian Sudan from the point of view of the ethnologist, and thus indicate some of the lines upon which future research may most usefully proceed.

[1] Abridged by the author.

Surprisingly little is yet known of the prehistory of this great area. No implement of river-drift type appears to have been found, and while admitting that this may be due to incomplete exploration, the fact seems of some significance considering the abundance of specimens of this type which have been found on the surface in Egypt, southern Tunisia, and South Africa. With regard to implements of Le Moustier type, I may allude to certain specimens which I have myself collected from two sites, namely, from Beraeis in north-west Kordofan, and from Jebel Gule in Dar Fung. At the former site I found a number of roughly worked unpolished stones. The majority are moderately thin broad flakes, showing a well-marked bulb of percussion, and little or no secondary working; other specimens are shorter and stouter. One surface is flat and unworked, the opposite curved surface shows a number of facets separated by rather prominent crests, all except the central facets sloping more or less steeply to the working edge. In some specimens the crests are sufficiently prominent to give a somewhat fluted aspect to the slope and a crenelated edge, one portion of which often shows signs of having been worn down and retouched. These implements, which I had suspected might have been Aurignacian, were considered by M. Breuil to belong to the Moustierian period, and he referred to the same period and industry some thick, fluted, and engrailed scrapers from Jebel Gule, which I have described as resembling the Palæolithic discs from Suffolk and other localities, as well as some implements of other forms which presented a Palæolithic facies. Besides the disc and Moustierian points, there is one implement which M. Breuil regards as a true, but much worn, *coup-de-poing* of Moustierian age. Whether all these really date from the Moustierian period or not, certain of the specimens from Jebel Gule show a surprising resemblance to South African specimens figured and described by Dr. L. Peringuey as of Aurignacian type, or, in other words, of the Capsien type of Tunisia.

Evidence concerning the later Stone age is furnished by a number of finds made on widely scattered sites; but though no explanation can be offered it should be noted that no stone implement of any kind has been recorded from the Red Sea Province, although it is one of the best known parts of the Sudan, and has been the scene of considerable engineering efforts. This is the more remarkable in view of the geographical features of the country; the absence of forest, the weathered plateaux, the valleys filled with deposits through which innumerable wadis have been cut, all suggest that if stone implements existed some at least should have come to light. Much interest attaches to the distribution of ground-stone axes in the Nile valley. While there is probably no museum with any pretence to an Egyptian collection which has not a number of these, and though they can be bought in almost every curio shop in Cairo, I have been unable to find any record of their discovery in a tomb group or undisturbed burial in Egypt; so that considering the number of prehistoric burials that have been examined, it can be said that they were scarcely if at all known in predynastic Egypt. On the other hand, they are common in Nubia, where a number have been found in predynastic and early dynastic tombs. Many examples have come from Meroë, and I believe that specimens occur on every site of Neolithic date in the Sudan. Moreover, the rock faces on which they were ground have been found both at Jebel Gule and Jebel Geili. We may therefore attribute a southern source to the ground-stone axes of the Nile valley, and in the light of our present knowledge regard them as of Negro origin. This view is sup-

ported by the results of recent work on the prehistory of the Sahara. Gautier, who has devoted much time to the ethnography of the French Sudan, points out, that while at the end of the Neolithic period the northern Sahara had a stone industry characterised by unpolished implements of Egyptian affinities, in the central and southern Sahara the typical implement was the polished axe, and that this was of Sudanese Negro origin. That the boundary of the two provinces, *i.e.* the Berber-Negro frontier, was then some 1000 kilometres further north than it is at present, is in no way opposed to this view. Besides the types already alluded to, Jebel Gule yielded a large number of pygmy implements of quartz, carnelian, and hornstone. These are similar to those found in South Africa and attributed to Bushmen, and there is reason to believe that this industry also existed at Faragab, where the innumerable disc beads of ostrich eggshell were probably bored with more or less worked-up slivers of quartz.

Some mention must be made of the existence of stone monuments of megalithic type in the Sudan, although their number is small and their origin obscure. There is a monolith about two metres high on the plateau overlooking the Khor el Arab near the Sinkat-Erkowit road, to which tradition says Mohammed tied his horse. Another monolith of much the same dimensions has been described and figured by Crowfoot from Isa Derheib, inland from Akik. At present there seems no reason to attribute any great antiquity to these stones; presumably they are connected with the upright stones and "stelai" of Axum. Probably other rude stone monuments will be found in the Red Sea province; indeed, I have heard of such, though the information was never very precise. It is, however, worth noting that typical dolmens do occur in the Madi country in the southern Sudan.

The only rock pictures as yet found in the Sudan are in northern Kordofan. For the most part they are outlined in red or blackish pigment, but a few examples occur chipped on lumps of granite, on the hillside at Jebel Kurkayla in the Jebel Haraza *massif*. These figures are very rough, and the examples reproduced by H. A. MacMichael all represent camels. Drawings with pigmented outlines are found on Jebel Haraza and Jebel Afarit, and from the artistic point of view seem to form two groups. To the first belong rough but spirited sketches of men on horseback, camels, and giraffes. The workmanship of the second group is rougher and much less vigorous; it includes representations of camels, men on horseback, and men marching or dancing, carrying the small round Hamitic shield. This, together with their general resemblance to the "Libyo-Berber" rock pictures of the southern Sahara, indicates a comparatively recent date for these drawings. Moreover, MacMichael notes that the work is faint and indeterminate, and that there is no trace of graving; in other words, the Neolithic tradition has not persisted.

One of the most difficult questions arising in connection with the Sudan is that of ancient Egyptian influence. Its existence may be readily granted, but what of its extent and duration? For while it is a platitude to say that a great and powerful State with a uniform tradition lasting for thousands of years cannot but have influenced the countries on every side, it must be confessed that where history fails the evidence is often extremely difficult to interpret. Every custom which at first sight seems to betoken Egyptian influence must be closely examined, and the evidence carefully sifted, to determine whether it may not have had its origin in the older and more generalised Hamitic culture of northern and eastern Africa. In discussing the value of the data upon which ideas and customs are to be traced back to an Egyptian origin, it is important to remember that general resemblances, either in widely distributed forms of social organisation and belief (*e.g.* matrilineal descent, cult of the dead, etc.), or in widely diffused technical devices (*e.g.* bow and arrow), cannot be admitted as good evidence. Whatever the future may bring, I do not think that in the present state of anthropological science even extreme and unusual beliefs and devices (which at first sight seem so strikingly convincing) should be considered as proof of common influence; otherwise it would be necessary to admit, immediately and without consideration, a cultural relationship between Papua and Central Brazil on the evidence of the phleme-bow, and between England and the Malay States on that of the fire-piston. It is only when there is a considerable consensus of agreement in underlying ideas and (or) in highly specialised customs or devices, that we are justified in considering an Egyptian origin, and even then it is necessary to bear in mind the possibilities of common ethnic origin and of "convergence." It is obvious that under these conditions facts will be differently interpreted, and opinions will vary within wide limits, while new discoveries may at any moment disturb views hitherto regarded as well founded.

Although I propose generally to confine myself to the area included in the Anglo-Egyptian Sudan, yet in considering the question of Egyptian influence in Negro Africa I shall overstep these limits. The records from the Belgian Congo, for example, are more numerous, while recent work in the north-west of Africa has provided material of much value from this comparatively new point of view.

With regard to the mode in which Egyptian influence was exerted on the Sudan there are three main routes along which we might expect to find its traces. The first is southwards along the Nile, the other two are to the west; one route at first following the Mediterranean coast but broadening westward as conditions become more favourable, the other running south-west through the oases and so communicating with Darfur and the Chad basin. Yet another route has been suggested by Sir Harry Johnston, namely, through Abyssinia and Somaliland, presumably reaching them *viâ* the Red Sea. Perhaps it was by this route that the sistrum, still used in the church festivals, reached Abyssinia.

The extension of Egyptian rule up the Nile valley can be traced from the earliest times to the XVIII. dynasty. But although after this Egyptian domination becomes less marked, Egyptian influence had become so firmly established that the culture of the states in the Nile valley had a predominantly Egyptian tinge[2]; first Napata, then Meroë, and then further south the States which we know later as the Christian kingdoms of Dongola and 'Alwah.

On *a priori* gounds the Nile route might be expected to be the most worn and the easiest to trace. For thousands of years Egyptian and Negro were in contact on the middle reaches of the great river, so that at least one great negroid kingdom arose; and though to this day a Negro dialect is spoken as far north as Aswan, yet at the present time there does not seem to be a single object or cultural characteristic which unequivocally can be said to have reached the zone of luxuriant tropical vegetation by way of the Nile valley.

[2] The early Ethiopian kings used the Egyptian language and writing for their records; it was only towards the end of the Meroitic period after the downfall of Egypt, that the Meroitic language was written. A special hieroglyphic alphabet founded on the Egyptian may date back to the third century B.C., but the actual Meroitic script is later than this. Crowfoot indeed argues for so late and short a range as from the middle of the second to the fourth century A.D. (Griffith, "The Meroitic Inscriptions of Shablûl and Karanog," chap. ii.).

The evidence for the earliest spread of Egyptian influence is set forth in the Reports of the Archæological Survey of Nubia. In the reports, Prof. Elliot Smith shows that beyond Aswan, as far south as exploration has proceeded, the basis of the ancient population from the earliest times to the end of the Middle Empire was essentially of proto-Egyptian type, and that this type became progressively modified by dynastic Egyptian influence from the north, and Negro and Negroid influence from the south. As a result, the Nubians contemporary with the New Empire present such pronounced Negroid characteristics as to form a group (the C group) which stands apart from its Nubian and Egyptian predecessors. The recent discoveries made by Prof. Reisner at Kerma in Dongola province show that here was a fort or trading post certainly occupied during the Hyksos period, and probably as far back as the VI. dynasty. It is the remains of the Hyksos period that are especially interesting. Reisner describes a people who razed the buildings of their predecessors, and buried their dead in the débris, who battered the statues of Egyptian kings of the XII. dynasty, and whose funerary customs were entirely un-Egyptian. Each burial pit contains a number of graves in every one of which several bodies had been interred. The chief personage lies on a carved bed; "under his head is a wooden pillow; between his legs a sword or dagger; beside his feet cowhide sandals and an ostrich-feather fan. At his feet is buried a ram, often with ivory knobs on the tips of the horns to prevent goring. Around the bed lie a varying number of bodies, male and female, all contracted on the right side, head east. Among them are the pots and pans, the cosmetic jars, the stools, and other objects. Over the whole burial is spread a great ox-hide." Reisner could not observe any marks of violence, but, judging from the contorted positions of some of the bodies, thought that they had been buried alive. The remains from these burials have been examined by Elliot Smith, who states that the skeletons surrounding the bedstead are those of folk of proto-Egyptian and Middle Nubian (C group) types, while those on the beds belonged to typical New Empire Egyptians, such as lived in the Thebaid at this time.

The first historical capital of the Sudan was Napata, the mediæval Merowe or Merawi, near Jebel Barkal, between the 19th and 20th parallels of latitude, a few miles south of the Fourth Cataract. Napata was certainly an important place in the XVIII. dynasty, but how much earlier is uncertain. In the XX. dynasty the high priest of Ammon assumed the viceregency of Nubia, and there is evidence that during the two succeeding dynasties the priestly families of Thebes set up at Napata a kingdom which, in theory at least, reproduced the theocracy of Ammon at Thebes. The first recorded lord of this new kingdom was Kashta, whose son Piankhi succeeded him about 741 B.C., and by 721 B.C. had conquered and garrisoned Egypt almost as far north as the Fayum. His brother Shabaka founded the XXV. (Nubian) dynasty, which lasted at least fifty years. Thus Napata was Egyptianised, and being a great trading centre cannot but have influenced profoundly the country to the south, so that when Meroe was founded in the eighth century B.C. the ruling influence must have been Egyptian. The mission sent by Nero to explore the Nile reported that Meroe was ruled by a Queen Candace, whose predecessors had borne that name for many generations. Yet, since the monuments show that a king was generally the head of the State, Pliny's assertion requires qualification; moreover, there is the perfectly definite reference to King Ergamenes slaughtering the priests who, as was the custom, had determined his death. In both statements I cannot but see examples of Egyptian theocratic influence. Nor are they mutually destructive if it be remembered that the throne might, and often did, pass in the female line, and that this practice was known to be in full force during the XVIII. and later dynasties. It would be entirely consonant with the policy of the priests of Ammon to take advantage of the spirit of the *sed* festival, the rite of ceremonial Osirification practised by the Egyptian kings, in order to obtain for themselves absolute political control. This would be the easier if among the barbaric tribes in southern Nubia the king was ceremonially killed as he recently was in Fazogli, and as he still is among the Nilotes. Strabo's description makes clear how relatively narrow was the stream of northern civilisation which penetrated Black Africa by way of the Nile valley. But even this civilisation did not come with a steady flow; when Egypt prospered under the early Ptolemies Meroe prospered; as Egypt decayed Meroe fell into the wretched condition recorded by Nero's officers; and even before this Candace could assert that neither the name nor condition of Cæsar was known to her. As northern influence lessened, and the power of Meroe decayed, the black element would preponderate more and more, so that the travellers quoted by Pliny who had actually visited Ethiopia told a story of barbarism and utter stagnation. But even in the earlier and better days when a king exerted real authority at Meroe it would be entirely consonant with African politics and African customs for vassal "kingdoms" to arise at the extremes of the State. So, when it is recorded on the authority of Eratosthenes that in the third century B.C. the Sembritæ who occupied an island south of Meroe were ruled by a "queen" but recognised the suzerainty of Meroe, we may think of the petty chieftains of the eighteenth century who were the true rulers of the country from Dongola to Sennar, though every sultan of Sennar claimed sovereign rights. There may have been many such "states" ruled by women, just as at the present day in the Nuba hills the highest authority passes in the female line, and may be exerted by a woman.

Meroe seems to have been destroyed before the introduction of Christianity. Nevertheless, two if not three culture phases can be traced in its history. There was first a period of Egyptian influence under King Aspelut and his successors, then came an influx of Greek ideas, a phase which Prof. Garstang would date from about the third century B.C. This is the period to which most of the monuments now visible belong, and it was succeeded by the period of Roman dominance. At Soba, on the Blue Nile a few miles above Khartum, Lepsius collected the cartouches of a number of kings and queens of Meroe; this site, the capital of the Christian kingdom of 'Alwah, was certainly inhabited through mediæval times, and may not have been fully deserted till three or four hundred years ago.

No doubt the territory over which the rulers of 'Alwah exerted authority extended south of their capital, yet beyond Soba, in the archæologically unexplored country south of the confluence of the two rivers, traces of northern influence quickly become fewer and less distinct. Nevertheless, at the present day among the hills between the White and Blue Niles the name Soba is still known, being recognised as that of a series of great queens who ruled over a mighty empire of the same name. The Fung or Hameg of Jebel Gule say that the great Queen Soba whom they worship was their ancestress, but they also apply her name to certain rocks which they regard as sacred. A prayer given me by a woman

at one of these rocks ran somewhat as follows: "Grandmother Soba . . . permit us to go on our journey and return in safety." There was obviously the utmost confusion in this woman's mind between Soba the goddess, who may be asked to relieve sickness, and Soba the stone, on which she had just placed a handful of sand. Few will doubt that in the Soba of the Hameg belief there is preserved the memory of such queens as Candace the ruler of the Sembritæ, grafted on the recollection of the great city, which to the Negroids of the Gezira no doubt appeared to dominate the north. Nor do these traces of ancient tradition stand alone; at Jebel Moya near the Blue Nile some 150 miles south of Khartum there is actual archæological evidence of northern influence. Here, besides stone implements, were found beads and amulets, a number of scarabs, and small plaques bearing Ethiopian and Egyptian cartouches ranging from about 700 B.C., or perhaps going back to an even earlier date. I may also note that on the as yet unexplored site of Faragab in northern Kordofan, besides potsherds, stone implements and ivory objects, I have found a carnelian bead, identified by Prof. Petrie as of XVIII. dynasty make, as well as dolomite and scolecite beads which are certainly not of Negro workmanship or character.

These sites seem to mark the southern limit of Egyptian influence as far as the actual transmission of objects derived from the north is concerned. Of the racial affinities of the inhabitants of Faragab nothing is known, but we are better informed concerning the old residents of Jebel Moya. The cemeteries of this site have yielded the remains of a tall coarsely built Negro or Negroid race with extraordinarily massive skulls and jaws. In a general way they appear to resemble the coarser type of Nuba living in South Kordofan at the present day, and it is significant that the cranial indices of the men of Jebel Moya and the Nuba hills agree closely. Thus there is the clearest evidence that Egyptian influence reached south of Khartum, and since it has persisted to the present day in oral tradition among the tribes of the little known country between the Blue and White Niles, traces might equally be expected among the Nilotes of the White Nile. But, strangely enough, nothing of the sort has been found, although the Shilluk and Dinka are better known than any other of the Sudan tribes. On the other hand, the tribes of the Congo basin have a number of customs which do suggest Egyptian influence, and the same may be said perhaps of Uganda, so that it seems reasonable to believe that Egyptian influence spread up the White Nile and passed westwards across the Nile-Congo watershed. An alternate route would be along the Blue Nile and its tributaries, the Dinder and the Rahad, to the Abyssinian hills, southward through the highlands to about 5° N., and thence westward to the head waters of the Congo.

To return to the Shilluk and Dinka, the most northern of the Negro tribes of the White Nile. The fact that no cultural elements which can be connected with Egypt are found on the White Nile, where they might have been expected, suggests either that the tribes now occupying the district were not there when Egyptian influence spread south, or that the country presented such difficulties that the foreign stream left it on one side, as would have been the case had it followed the route *via* the Blue Nile and the highlands of Abyssinia. In other words, either the Shilluk and Dinka reached their present territory in comparatively recent times, or else led a wandering and precarious life in swamps as formidable as the Sudd of the present day. There is, I think, a good deal in favour of the latter view. The existence in the depths of the Sudd of Nuer communities, of which we know little except through rumour, shows that such a life is possible; while among the Dinka the Moin Tain, or "marshmen," who possess no cattle and scarcely cultivate, but live by hunting and fishing, exist under almost as unfavourable conditions. Moreover, there is abundant evidence that North-West Africa is drier now than it was a few thousand years ago, and if those authors are right who state that there was a general melting of glaciers in Eur-Asia some 5000 years B.C., giving rise to widespread floods (the origin of the Biblical deluge), the increased precipitation may well have given rise to a considerable northern extension of the Nile swamps. In support of this argument, it may be noted that in numerous XVIII. dynasty paintings Negroes are represented with bows and arrows and throwing sticks (boomerangs), *i.e.* their weapons are not those of the northern Negroes of the present day, the Shilluk and Dinka, who are not bowmen and do not use the throwing stick. Shilluk traditions state that they came from the south, and a language substantially identical with theirs is spoken by the Acholi of the Uganda Protectorate.

Evidence pointing in the same direction exists on the physical side; the results of the archæological survey of Nubia show that even in late dynastic times the tall Negroids (E-group) whose skeletons have been found near Shellal were mesaticephals, with a cephalic index higher by three or four units than those of the Dinka and Shilluk respectively. On the other hand, a people with a cephalic index nearer that of the northern Nilotes had reached Nubia by the Byzantine-Pagan period (200–600 A.D.). Elliot Smith and Derry speak of these people (the X-group) as prognathous and flat-nosed Negroids who suddenly made their way north into Nubia. Sixteen X-group skulls (eleven male and five female) in the College of Surgeons give a cephalic index of 70·8, and, comparing them with the series of about the same number of Dinka skulls in the collection, my impression is that as a group they show as many Negroid characters.

The numerous records of Negro incursions from the Middle Kingdom onwards suggest that the Negroes were driven north in a succession of waves by some force from which this direction offered the only chance of escape. Such can only have been applied by other Negroes behind them. It may well be that there was more or less continual ferment on the southern border of Egypt in the early part of the first millennium B.C., and that the northern Nilotes were beginning to make their reputation as fighting men. Indeed, the passage in Isaiah can scarcely bear any other meaning than that this people was working north with sufficient energy for their peculiarities and those of their land to have become known to the Mediterranean world. "Ah, the land of the rustling of wings, which is beyond the rivers of Ethiopia: that sendeth ambassadors by the sea, even in vessels of papyrus upon the waters, saying, Go, ye swift messengers, to a nation tall and smooth, to a people terrible from their beginning onward; a nation that meteth out and treadeth down, whose land the rivers divide!" (Isa. xviii. 1, 2, Revised Version). But while the tall Negroes seem to have been the first to reach Nubia in organised groups, stray examples of short brachycephalic Negroes (usually female) have been found as far back as protodynastic times. I am indebted to Prof. Elliot Smith for the information that the four Negresses found in cemetery No. 79 at Gerf Hussein were short in stature with relatively broad oval crania, while at Dabod in a Middle-Kingdom cemetery there was found a skeleton of a

man measuring 1·61 m. (about 5 ft. 3 in.), with definite prognathism, typical Negro hair, and a cephalic index of 80. Presumably these were representatives of the group of short mesaticephalic Negroes who are at the present time found on both sides of the Nile-Congo divide, but predominantly west of it, a group represented by the Bongo, Azande, and cognate tribes. We thus reach the position that the Nubians, who were proto-Egyptians, were, in the earlier part of their history, in contact with just that class of Negroes among whom customs and ideas apparently of Egyptian origin are found at the present day. It must not, however, be assumed that it was this contact that led to the dissemination of Egyptian ideas; indeed, our present information suggests that it can scarcely have been sufficiently intense.

The following table, giving the measurements and indices available for the comparison of the E-group Negroids with the tall Negroes of the present day, shows that the former belonged to the mesaticephalic group, which includes the Burun, the Bari, and the Nuba. As regards head length, head breadth, cephalic index, and stature, the E-group stands closer to the Nuba than to the other tribes, while even in head breadth it is as near the Nuba as the Dinka.

	H.L.	H.B.	C.I.	Stature
Shilluk ...	195	139	71·3	1776
Dinka ...	194	141	72·7	1786
E-group ...	190[3]	143[3]	75·68[3]	1723
Nuba ...	190	145	76·6	1722
Burun ...	190	150	79·16	1759
Bari ...	190	149	78	1741

At the present day the mesaticephalic group includes the Hameg and the Berta of the hills between the White and Blue Niles. The excavations at Jebel Moya—also between these two rivers—have enabled Dr. Derry to show that in Ptolemaic times this hill stronghold was inhabited by tall mesaticephali with a cephalic index almost identical with that of the Nuba, so that we are led to conclude that all these tribes, including the E-group Negroids, belong to one and the same stock.

A number of similarities between ancient Egypt and modern Africa have been set out recently by Prof. Petrie. He does not discuss the routes by which Egyptian influence may have reached Negroland, but simply marshals the evidence of similarity under sixty-one headings. A good many of these are so widely spread outside Africa as to be of little evidential value; others, and this applies specially to material products, include such simple or obvious devices that they can scarcely be regarded as carrying weight; but there are a number of instances which are highly suggestive, and when to these are added yet other habits and customs common to ancient Egypt and Negro Africa, a mass of evidence is presented which seems decisively indicative of Egyptian influence. This view does not imply that all the features common to ancient Egypt and present-day Negroes are instances of borrowing; on the contrary, I hold that many common customs are but expressions of the wide diffusion of old Hamitic blood and ideas. To this ancient stratum I would attribute those customs which I have discussed in a previous paper, including burial by the Nilotes in the crouched position, the use of the throwing-stick (boomerang) by the Beja, and the killing of the divine king (or rainmaker).

The ideas and customs reported from tropical Africa which may be due to Egyptian influence may be classified provisionally in the following groups, though the space at my disposal here permits only a brief reference to the third group:—

(i) Beliefs connected with the soul.

(ii) Beliefs and customs connected with the king or the royal office.

(iii) Death customs.

In Egypt the body was prepared for the grave by an elaborate process of mummification; it was then enclosed in a coffin, often of anthropoid shape. In tropical Africa numerous instances of attempts to preserve the body are recorded. In Uganda the body of the king was opened, the bowels removed, emptied, washed in beer, dried, and then replaced, while among the Banyoro and the Makaraka other methods were adopted. It seems a far cry from the mummies of Egypt to the smoke-dried corpses of Equatoria, and it is not difficult to see that ancestor worship might easily give rise to attempts to preserve the body when everyday experience would suggest desiccation or smoking, but there are certain Congo tribes whose practices do suggest an actual link with Egypt. Among the Wambunda of Stanley Pool the body is placed in the squatting posture, the limbs are tightly flexed on the body and tied in that position, the whole being packed with a large quantity of spongy moss which is kept *in situ* by bandages. A gentle fire is kept up round the body for two or three months, after which it is rolled in native cloths and buried. The latter part of this ceremony hints that the attempts to preserve the corpse may have been imposed on an older habit of speedy burial; such an imposition could only have come from without.

Among the Wangata an important person of either sex is buried in a massive coffin with a lid carved to represent the deceased. It is difficult not to believe that here is an echo of the Egyptian mummy case. If this be so, may not the practice of a tribe near Lake Leopold II., who, after a rough preparation of the body, roll it in native cloth and place it in a canoe-shaped coffin, be regarded as connected with the funerary boats of Egyptian burial ceremony? Since the anthropoid coffin was unknown before the XI. dynasty, it follows that the northern influence must have been exerted after this period. Egypt's first great expansion (after the pyramid builders) dates from the XII. dynasty, when Egyptian and Negro were in intimate contact at the Second Cataract, as shown by the celebrated decree of Senusert III. Further, about this time special importance seems to have been attributed to the funerary voyage on the Nile, indeed, almost all the models of funerary boats in our collections are of this period.

If these facts be accepted as evidence of the date at which Egyptian ideas influenced equatorial Africa, there are other customs which seem to indicate that this was not the only period of such cultural drift. The coffins of the III. and IV. dynasties were often large rectangular boxes designed and painted to represent houses. Now the Mayumbe roll the body of a dead chief in layers of cloth and place it in an enormous wooden coffin of rectangular shape, the top of which is carved to present a homestead. Again, the funeral ceremonial of the Ndolo seems reminiscent of this period. Immediately after death the Ndolo prepare the body, painting it red, touching up the eyebrows with charcoal, and propping it up with open eyes and mouth on a high seat in the very posture of the *ka* statues of the pyramid-builders, *i.e.* seated with the forearms and hands upon the thighs, a position which I venture to say no Negro would adopt. The body remains here for a day, while more or less continual drumming and dancing go on, and is then buried.

[3] The H.L. and H.B. of the E-group skulls have been increased by 7 mm. and 8·5 mm. respectively in order to make these measurements comparable with those on the living. For the same reason the C.I. has been increased by 2 units.

The form of an Egyptian mastaba tomb was to a very great extent the expression of the Egyptian belief that the soul, or souls, of the deceased visited the body in the tomb chamber, coming in and out by the shaft of the pit, and indeed the XVIII. dynasty papyrus of the priest Nebqed represents the human-headed *ba*-soul descending the shaft to visit the mummy. These beliefs also led to the burial of supernumerary stone heads to which the soul might attach itself should the body perish. Recently eight life-size portrait heads of a princess and the courtiers of the court of Chephren have been found in the mastabas at Gizeh constituting the royal cemetery of the fourth dynasty. The cartonnage busts, presumably of the deceased, represented as carried in funeral processions of the Middle Empire, are probably a development of the same idea. Similar expressions of belief—perhaps most obvious in tomb construction—occur in Negro Africa, the examples being too numerous and the resemblances too exact for this to be due to any other cause than actual borrowing.

To sum up: concerning the early prehistory of the Anglo-Egyptian Sudan we have no more than indications. In the Neolithic stage, which appears to have persisted until a comparatively recent date, Negro influence, if not predominant over the whole area, was at least powerfully felt even in the north, as is shown by the distribution of polished axe-heads. But against this northward pressure must be set the continual extension of Egyptian culture, the evidence for which may best be found in the eschatological ideas and burial customs ("mummification" and anthropoid coffins) of the peoples of Equatoria. This influence, which seems to have persisted until medieval times, may have reached tropical Negroland as early as the Middle or even the Old Kingdom. Nor was the Nile route the only one by which Egyptian influence was spread. Another and later drift extended westwards, as shown by the coinage of the north African States, which enables us to fix its date within fairly precise limits. We do not know how far south this drift travelled, but it seems certain that it reached at least as far as the Senegal River and the great bend of the Niger.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—Prof. J. A. Fleming will give a public introductory lecture at University College, on "Science in the War and after the War," on Wednesday, October 6, at 5 p.m. This lecture will be open to the public without fee or ticket. Other free public lectures are as follows:—On October 6, at 2 p.m., Photographic Surveying, by Mr. M. T. M. Ormsby; on October 7, at 2 p.m., The History of Tools, by Prof. W. M. Flinders Petrie, and at 5 p.m., Final Causes in Animal Psychology, by Mr. Carveth Read; on October 8, at 5 p.m., The Physiological Action of Light, by Prof. W. M. Bayliss, and at 5.30 p.m., Steam Turbines, by Mr. W J. Goudie; on October 11, at 3 p.m., Racial Frontiers in Central and South-eastern Europe, by Prof. L. W. Lyde; on October 12, at 5 p.m., An Investigation of the Heating of the House of Commons, by Mr. A. H. Barker; and on October 29, at 5 p.m., The Applications of Electric Heating, by Prof. J. A. Fleming.

The University Officers Training Corps, under the command of Lt.-Col. D. S. Capper, will begin its eighth year of training under exceptional conditions, as the colleges of the University are largely depleted of students. In the infantry unit, the largest in the contingent, the training since the outbreak of the war has been mainly of a continuous character, cadets being accommodated in premises near London. As a rule, a few months of training under these conditions have been sufficient to qualify cadets for commissions. The artillery and engineer units of the contingent are also in active training. Their work is especially important at the present time, as there are so few facilities for the training of technical officers. The artillery unit has been permitted to keep its guns and equipment for training purposes. In the medical schools of the University, a considerable number of students are completing their medical training with a view to taking commissions as soon as qualified. The strength and training of the medical unit of the University O.T.C. have therefore not been much affected by the war, and the cadets attended camp as usual. Since the outbreak of war, the number of commissions obtained by cadets and ex-cadets of the contingent up to the end of August, 1915, amounts to 1521, and 189 commissions were obtained before the war, giving a total of 1710. In addition, 245 commissions have been obtained, up to the same date, upon the recommendation of the University, by graduates and students who were not cadets or ex-cadets of the University O.T.C. Before the end of September, the University will have supplied well above 2000 officers to the Army through the O.T.C. or by direct recommendation, and many other graduates and students have obtained commissions through other channels. Distinctions obtained by ex-cadets of the University O.T.C. include:—Military Cross, 6; Medaille Militaire, 1; Mentioned in Dispatches, 14. Under War Office Regulations, membership of the University of London O.T.C. is not restricted to members of the University, and other men of suitable education desirous of qualifying for commissions are accepted Candidates for enrolment should apply personally to the Adjutant at the Headquarters, 46 Russell Square, W.C.

MR. W. CALDWELL, of Trinity College, Dublin, has been elected professor of chemistry and professor of physics in the Schools of Surgery of the Royal College of Surgeons in Ireland.

IN July last the Federation of University Women offered a prize fellowship of 80*l.* to 100*l.* for original work published by women. We learn that the fellowship has been awarded to Miss M. Wheldale, Newnham College, Cambridge.

THE new session of the School of Pharmacy of the Pharmaceutical Society will open on Wednesday, October 6, when the inaugural address will be delivered by Sir Rickman J. Godlee, and the Hanbury gold medal presented by the president.

THE will of the late Mr. George May, mining engineer and colliery proprietor, of Darlington, bequeaths 500*l.* to the North of England Institute of Mining Engineers, the income to be applied in providing "George May" prizes for students, and 500*l.* to Armstrong College, Newcastle, to found a "George May" scholarship in mining.

THE London County Council has arranged for the undermentioned free public lectures to be given at the Horniman Museum, Forest Hill, S.E., at 3.30 p.m. on Saturday afternoons, commencing on October 2: The folk-lore of Russia, Mr. Edward Lovett; the Belgian Congo, its peoples and its animal life, Rev. J. H. Weeks; Rumanian history and folk-lore, Mr. A. R. Wright; (1) our Western Allies, (2) our Eastern Allies, Dr. A. C. Haddon; the folk-lore of France, Mr. E. Lovett; Japanese history and folk-lore, Mr. A. R. Wright; (1) flies as enemies of man, (2) the dangerous parasites of man, Mr. H. N. Milligan; S. Sophia,

Constantinople, and the mosques of Constantinople and Brusa, Prof. F. M. Simpson.

THE calendar of Birkbeck College, London, for the present session has been issued. The arrangements made for the session, which is the ninety-third, are as complete as in previous years. The general character of the educational work provided by the college is summarised in the Final Report of the Royal Commission on University Education in London (1913); the Commissioners write:—"We think that the original purpose of the founder of Birkbeck College and the excellent work that institution has done for the education of evening students who desire a university training, mark it out as the natural seat of the constituent college in the Faculties of Arts and Science for evening and other part-time students." In addition to the university courses arranged in science, arts, laws, and economics, classes will be held in commercial and other subjects.

THE British Fire Prevention Committee's "Fire Warnings" have been before the public from time to time in connection with the war emergency, but the different forms of "Fire Warnings" available and the extent to which they can be obtained gratuitously does not appear to be generally known. Among the "Fire Warnings" obtainable in poster form, printed in red, 8 ins. wide, are the following—the reference number must be given in all communications regarding them:—For elementary and secondary schools: *re* air raids (No. 20); for public schools and boarding schools: *re* air raids (No. 20*a*); *re* fires due to air raids (No. 17): for householders, etc.; *re* fires due to air raids (No. 17*a*): as to dealing with incendiary bombs, etc. Local authorities and school committees—as also headmasters or headmistresses—requiring "Warnings" No. 20 and 20*a* (for schools) will receive a suitable number of copies free upon written application to the registrar, giving the full name and postal address of the institution for which they are required, the number of pupils, subject to their enclosing a large-sized, addressed, and properly stamped envelope for despatching the necessary posters. All communications should be in writing addressed to the Registrar, the British Fire Prevention Committee, 8 Waterloo Place, London, S.W. More than a quarter of a million posters has already been issued by the committee gratuitously.

THE educational and social announcements for the present session at the Northampton Polytechnic Institute, Clerkenwell, London, have been issued in the form of an attractive calendar. The only new evening class which has been arranged is a "Glass-workers'" evening course, which is being jointly undertaken by the technical optics and the technical chemistry departments. The class is required urgently at the present time, owing to the disturbance in this particular trade caused by the war. Notwithstanding the war, the equipment of the various departments was extended during the session 1914–15. In the mechanical engineering department, the testing equipment was increased by the addition of a Heenan and Froude dynamometer, and the prime mover equipment by a semi-Diesel engine. In the electrical engineering department, various transformers and motors of special types were added, and a Tirrell regulator and a mercury arc rectifier were installed. The instrument equipment was also extended. In the technical optics and other departments, a fair amount has also been spent on extensions. The courses in the Engineering Day College are to be continued, but the second- and third-year courses, which extend ordinarily from September to Easter, are in 1915–16 to commence in January and to be continued until July. This arrangement will enable the students to work up to Christmas in the munitions workshop, which has been employed in making gauges and parts of armaments during the whole of the summer vacation. The special classes for Post Office workmen and boy messengers, started two years ago, are being continued, as are also those in submarine cable work for the employees of the cable companies who have their headquarters in London.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, August 30.—M. Ed. Perrier in the chair.—The president announced the death of Emile Guyou, member of the Academy.—G. **Humbert**: The reduction of Hermite forms in an imaginary quadratic body.—D. **Pompeiu**: A double solution of Riccati's equation.—B. **Mayor**: A correspondence between articulated systems of space and those in a plane.—M. **Gibon**: New methods in stereo-radioscopy. Radioscopic methods are more rapid than radiographic methods, and three processes of stereo-radioscopy are described. The first process makes use of two Crookes's tubes, with a metallic diaphragm placed between the bulbs and the patient, a stereoscopic image being formed on a platinocyanide screen.—P. W. Stuart **Menteath**: Some fossils of the Pyrenees.—J. **Pescher**: Respiratory gymnastics and its therapeutic effects. Drawings of the instrument are given, and its use and mode of application are described. Cases are cited in which its systematic employment has given beneficial therapeutical effects.—Edmond **Bordage**: The differences in the appearance of adipose tissue produced by hystolysis in certain Orthoptera.

September 13.—M. Camille Jordan in the chair.—G. **Bigourdan**: Astronomical observations made in France before the foundation of the Academy of Sciences and the Observatory of Paris. An account of the work of early French astronomers up to the sixteenth century.—A. **Chauveau**: Diffuse inflammation of the forearm resulting from a previous general infection.—Paul **Vuillemin**: Essential differences between the nasturtium and the Geraniaceæ. Tropæolum differs fundamentally from the Geraniaceæ in the position of its nectaries and in the typical number of stamens. The author considers it necessary to re-establish the family of Tropælaceæ.—MM. **Tuffier** and **Amar**: Walking-sticks and crutches. Scientific model of a supporting cane. This is designed to prevent forms of paralysis frequently resulting from the use of ordinary crutches.—B. **Galitzine**: The direct measurement of accelerations. A continuation of an earlier paper on the same subject.—A. **Portevin**: The decomposition of potassium cyanate by heat. The reaction $KCN+O=KCNO$ is reversible, potassium cyanide being formed by heating potassium cyanate, in proportions ranging from 20·9 per cent. at 700° C. to 48·9 per cent. at 900° C.—E. Kohn **Abrest**: An arrangement for rapidly testing substances used against poisonous gases. The results obtained with various absorbents for chlorine are tabulated. The solutions containing sodium bicarbonate were not so effective as those with sodium carbonate. Sodium thiosulphate alone gave off SO_2, but in admixture with excess of sodium carbonate the absorptive power was good. Solutions of potassium iodide gave very complete absorption.—Léon **Gizolme**: The influence of the algæ of sand filters on the chemical composition of water. The amount of dissolved oxygen was found to increase and the alkalinity to diminish with increase of sunlight.

Curves are given showing the change in the dissolved oxygen and in the alkalinity with the time of day, and one curve is the exact inverse of the other. These results are attributed to the development of the chlorophyll activity of algæ.—J. **Tissot**: The most favourable conditions for the rapid cicatrisation of wounds. Recent work by Dakin and Carrel aims at the production of a slightly toxic, strongly antiseptic, and non-irritant solution for treating wounds. The author holds that the irritating action of such solutions is essential to their curative action, and shows that various accepted methods of treatment, either physical or chemical, are based on their irritating action. Although the antiseptic properties of alkaline hypochlorites are very high, their favourable action is regarded as being less the result of their bactericidal effects than to their stimulating or irritating effects on the tissues.—M. **Marage**: The treatment of deafness resulting from wounds in war. An account of the results achieved by the application of the methods proposed in an earlier communication. Two-thirds of the cases were able to return to the front as cured.—J. **Rodhain**: The biology of *Stasisia rodhaini*.—E. **Roubaud**: The production and autodestruction of domestic flies by horse manure.

September 20.—M. Ed. Perrier in the chair.—J. **Boussinesq**: Remarks and calculations showing that the complication of the formulæ for large displacements of deformable bodies is due, not to the deformations, but to the rotations.—Wilfrid and Conrad **Kilian**: A reef formation containing stromatospores in the Urgonian of Chamechaude (*massif* of the Grande Chartreuse).—Edouard **Heckel**: The transmission by seeds of the effects of castration in maize stems. It has been shown that one effect of male castration in maize is to increase the amount of sugar in the stems. This has been carried out for four successive years, and it has now been proved that this increased proportion of sugar in the stems can be transmitted by the seeds.—Pierre **Humbert**: The bifurcations of Jacobi's ellipsoids.—C. **Camichel**: Hammering in pipes; oscillations in mass.—Jules **Andrade**: Chronometric methods for the measurement of the terrestrial magnetic field. A magnetised needle is connected with the balance wheel of a non-magnetisable chronometer in such a manner as not to interfere with the equilibrium with respect to the axis of rotation of the balance wheel. The theory of the determination of the magnetic field from the rate of the chronometer is developed, and it is shown that a high accuracy can be obtained.—Jean **Pougnet**: The action of ultraviolet light upon solutions of mercuric chloride and upon some mercury salts. Solutions of mercuric chloride are rapidly decomposed by light from a mercury vapour quartz lamp, calomel being deposited. The reaction is to a certain extent reversible, since calomel suspended in water and submitted to the ultraviolet rays gives some mercuric chloride. Many slats of mercury are also shown to be affected by the same treatment.—R. **Chudeau**: Atmospheric pressure in western and equatorial Africa.—Jean **Mascart**: Description of a localised storm.—B. **Baillaud**: Remarks on the preceding paper.—A. **Moutier**: The troubles of arterial circulation under war conditions. All the subjects returning from the battlefield present a radial hypotension. Other circulatory troubles are frequently observed locally in the neighbourhood of wounds. Treatment having for its aim the regularisation of the arterial circulation will aid conservative surgery and will sometimes remove the necessity for amputations.—A. P. **Dustin**: The method of experimental parthenogenesis of Delage and its mode of application.—A. **Brachet**: The cyclic evolution of the cytoplasm of the fertilised egg.—Mlle. A. **Raphael** and V. **Frasey**: The toxin of the septic vibrion and the corresponding antitoxin. The septic vibrion give in twenty-four hours a very active toxin, which can be easily and rapidly titrated on the rabbit. The immunisation of the horse against the poison can be made rapidly and without danger. The serum thus obtained shows antitoxic and anti-infective properties when used on laboratory animals both against the septic vibrion and *Bacterium chauvoei*.—Em. **Bourquelot** and A. **Aubry**: The biochemical synthesis of the α-monoglucoside of ordinary propylene glycol with the aid of α-glucosidase.

WASHINGTON, D.C.

National Academy of Sciences (Proceedings No. 9, vol. i.).—Alice C. **Fletcher**: The Indian and Nature. Glimpses are given of the line the Indian pursues in his endeavour to express his view of Nature and of the relation he believes to exist between its various forms and forces and himself.—Jacques **Loeb**: The mechanism of antagonistic salt action. The author studies the effect of the concentration C of the salt at the external surface of membranes in addition to the concentrations C_i and C_{ii} of the salt outside and inside the membrane, and finds that C_{iii} is serviceable in explaining the mechanism of antagonistic salt action in certain cases.—Chas. B. **Lipman**: The nitrogen problem in arid soils. A summary of some recent investigations and field manifestations with reference to their bearing on problems of soil fertility in California.—F. H. **Seares**: A notation for use in the discussion of star colours. The extension of absolute scales of photographic and photovisual magnitudes to the fainter stars provides a method of determining the colours of objects at present beyond the reach of spectroscopic investigation, and it is convenient in the statistical discussion of such colour results to introduce a notation similar to that used for spectral classification. The letters *b*, *a*, *f*, *g*, etc., are used to correspond to *B*, *A*, *F*, *G*, etc.—F. H. **Seares** and H. **Shapley**: Condensation, colour, and magnitude in star clusters. Neither N.G.C. 1647 nor M 67 show any dependence of condensation upon colour which cannot be explained on the basis of included background stars; there seems to be little, if any, dependence of condensation upon magnitude, but there is a marked relation between colour and magnitude in N.G.C. 1647, and a less pronounced relation in M 67.—H. S. **Uhler**: Thiele's "phase" in band spectra. The author outlines an interpolation method for determining c in the formula $\lambda = f[(n+c)^2]$, which is much simpler than using Thiele's complicated formula.—E. G. **Conklin**: Why polar bodies do not develop. The second or internal factor in normal fertilisation is a non-diffusible substance which is introduced by the spermatozoon, and it is strongly suggested that this factor is the sperm centrosome, a position which Boveri has long maintained, and which the author has hitherto contested. Giant polar bodies do not develop because they are not fertilised, and they are not fertilised because they are generally formed after a spermatozoon has entered the egg and has rendered it impervious to other spermatozoa.—W. W. **Campbell** and J. H. **Moore**: Radial velocities of the planetary and irregular nebulæ. The fact that the gaseous nebulæ have motions which are characteristic of the stars, and their concentration in the Milky Way, indicate that these nebulæ are members of our stellar system. The great velocities of the nebulæ in the Magellanic Clouds and other considerations lead to the hypothesis that the Magellanic Clouds are isolated cosmic units with no apparent connection to our own stellar system.

CALCUTTA.

Asiatic Society of Bengal, September 1.—Rai **Monmohan Chakravarti** Bahadur: Notes on the geo-

graphy of Orissa in the sixteenth century. The author attempts to discuss in this paper all the geographical information available about Orissa in the sixteenth century. His main authorities are the *Mādalā Pāñji*, or the Chronicles of Jagannatha Temple in Puri (Orissa), and the *Aine-i-Akbari* of Abul Fazal. This information is checked and supplemented by information available at the time of the early British occupation, and obtained by personal inquiries made during his service in Orissa for thirteen years.

BOOKS RECEIVED.

L.M.B.C. Memoirs on Typical British Marine Plants and Animals. XXIII. Tubifex. By G. C. Dixon. Pp. viii+100+vii plates. (London: Williams and Norgate.) 3*s*. 6*d*.

Practical Organic and Bio-Chemistry. By R. H. A. Plimmer. Pp. xii+635. (London: Longmans and Co.) 12*s*. 6*d*. net.

On the Relation of Imports to Exports. By J. T. Peddie. Pp. v+88. (London: Longmans and Co.) 2*s*. 6*d*. net.

The Birth-Time of the World, and other Scientific Essays. By Prof. J. Joly. Pp. xv+307. (London: T. Fisher Unwin, Ltd.) 10*s*. 6*d*. net.

Elementary Photo-Micrography. By W. Bagshaw. Third edition. Pp. 143. (London: Iliffe and Sons, Ltd.) 2*s*. 6*d*. net.

Lord Kitchener and his Work in Palestine. By Dr. S. Daiches. Pp. 88. (London: Luzac and Co.) 2*s*. 6*d*. net.

Flora of the Upper Gangetic Plain and of the Adjacent Siwalik and Sub-Himalayan Tracts. By J. Duthie. Vol. iii., part i. Pp. 168. (Calcutta: Superintendent Government Printing, India.) 1*s*. 10*d*.

Germany's Violations of the Laws of War, 1914–15. Compiled under the auspices of the French Ministry of Foreign Affairs. Translated by J. O. P. Bland. Pp. xxxviii+343. (London: W. Heinemann.) 5*s*. net.

A Manual of Mechanics and Heat. By Prof. R. A. Gregory and H. E. Hadley. Pp. viii+309. (London: Macmillan and Co., Ltd.) 3*s*.

The Essentials of Illustration. By T. G. Hill. Pp. xii+95. (London: W. Wesley and Son.) 10*s*. net.

Qualitative and Volumetric Analysis. By W. M. Hooton. Pp. 86. (London: E. Arnold.) 3*s*. net.

Smithsonian Institution. Bureau of American Ethnology. Bulletin 46: A Dictionary of the Choctaw Language. By C. Byington. Edited by Dr. J. R. Swanton and H. S. Halbert. Pp. xi+611. (Washington: Government Printing Office.)

The New Psychiatry. By Dr. W. H. B. Stoddart. Pp. iv+67. (London: Baillière & Co.) 3*s*. 6*d*. net.

Papers from the Geological Department, Glasgow University. Vol. i., 1914. (Glasgow: J. MacLehose and Sons.)

Birds and Man. By W. H. Hudson. New edition. Pp. 306. (London: Duckworth and Co.) 6*s*. net.

The Foundations of Normal and Abnormal Psychology. By Dr. B. Sidis. Pp. 416. (London: Duckworth and Co.) 7*s*. 6*d*. net.

Child Training. By V. M. Hillyer. Pp. xxxix+299. (London: Duckworth and Co.) 5*s*. net.

Birkbeck College Calendar, 1915–16. Pp. 134. (London.) 3*d*.

Manuals of Chemical Technology. III. Industrial Nitrogen Compounds and Explosives. By Dr. G. Martin and W. Barbour. Pp. viii+125. (London: Crosby Lockwood and Son.) 7*s*. 6*d*. net.

The Solar Eclipse of August 21, 1914. By C. Størmer. Pp. 6+iv plates. (Kristiania: J. Dybwad.)

A Manual of the Chikaranga Language, with Grammar, Exercises, Useful Conversational Sentences and Vocabulary. By C. S. Louw. Pp. x+397. (Bulawayo: Philpott and Collins.) 12*s*. 6*d*. net.

Wales: Her Origins, Struggles, and Later History, Institutions, and Manners. By G. Stone. Pp. xxxvi+455. (London: G. G. Harrap and Co.) 7*s*. 6*d*. net.

Documents Scientifiques de la Mission Tilho (1906–1909). Tome Troisième. Pp. vii+484+plates. (Paris: E. Larose.)

DIARY OF SOCIETIES.

MONDAY, OCTOBER 4.

SOCIETY OF ENGINEERS, at 7.30.

WEDNESDAY, OCTOBER 6.

ENTOMOLOGICAL SOCIETY, at 8.—Contributions to the Life-histories of *Latiorina pyrenaica*, *Agriades escheri*, and *Scolitantides arion*: Dr. T. A. Chapman.—The Life-history of *Lycaena arion*: F. W. Frohawk and Dr. T. A. Chapman.

THURSDAY, OCTOBER 7.

EUGENICS EDUCATION SOCIETY, at 5.15.—Eugenics and the Doctrine of the Super-man: Prof. J. A. Lindsay.

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